Record of Decision
Remedial Alternative Selection

Site: Ambler Asbestos Piles, Ambler, Pennsylvania

Statement of Basis and Purpose

This decision document represents the selected remedial action for the first operable unit at the Ambler Asbestos Site, in Ambler, Pennsylvania, developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 (CERCLA), 42 U.S.C. Section 9601 et seq. and to the extent practicable the National Contingency Plan (NCP), 40 C.F.R. Part 300. This decision is documented in the contents of the administrative record for this site. The attached index identifies some of the items which comprise the administrative record upon which the selection of the remedial action is based (the administrative record will be updated in the near future). The Commonwealth of Pennsylvania has concurred on the remedy.

Description of the Selected Remedy

The selected remedy for the first operable unit seeks to prevent the release of asbestos from the site. A vegetative/soil cover will be installed over each of the two asbestos-containing waste piles (Locust Street-Pile and Plant Pile) to prevent airborne emissions, runoff will be collected and treated to assure no waterborne asbestos can go off site.

Additional components of the selected remedy are as follows:

- A geotextile and soil cover will be installed on the exposed plateau areas of the Locust Street and Plant Piles and on the exposed side slope areas of the Locust Street Pile.

- Repair to erosion on waste pile slopes due to storm events, soil creep, freeze/thaw effects, etc., will be implemented.

- Water from the lagoon and settling basins will be pumped and filtered for removal of asbestos fibers. Discharge of the treated water will occur on-site with placement of filter backwash on waste piles.

- The lagoon and settling basins will be backfilled with clean low permeability compacted soil bringing the depression up to grade to promote long-term positive drainage.

- Additional borings will be collected into and through the pile side slopes to supplement slope stability analysis previously performed.

- Slope stability control measures will be analyzed and implemented if the aforementioned studies are found to provide evidence of slope instability.

- Gabions or rip-rap will be installed to protect the toe of the Locust Street Pile from the scouring action of the Wissahickon Creek.

- Erosion/sedimentation controls during remedial activities will be implemented to facilitate the establishment of vegetation.

- Air monitoring for asbestos will occur during remedial activities (personnel and environmental).

- Post-closure inspections, maintenance of the piles, lagoon, and settling basin areas, and preparation of a contingency plan will be accomplished.

Other alternatives will be further evaluated as part of a Preremedial Design study to determine whether to pilot test for, and possibly institute, one of these alternatives for the site. If found to be unacceptable, based upon EPA's evaluation criteria under CERCLA for remedial actions, the Alternative 4 will immediately be implemented.

If any alternative processes are found to be acceptable, based upon EPA's evaluation under CERCLA for remedial actions, EPA would amend the ROD. Public comment would be solicited in the event of ROD amendment.

Declaration

The selected remedy is protective of human health and the environment, attains Federal and State Requirements that are applicable or relevant and appropriate to this remedial action and is cost-effective as set forth in Section 121 of CERCLA, 42 U.S.C. Section 9621(c) and Section 300.68 of the NCP. This remedy satisfies the statutory preference as set forth in Section 121(b) of CERCLA, 42 U.S.C. Section 9621(b) for remedies that employ treatment that reduce toxicity, mobility or volume of the hazardous substances, pollutants or contaminants. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. However, because treatment of the principal threat of the site was not found to be practicable, this remedy does not accomplish the statutory preference for treatment as a principal element of the remedy. It should be noted that, since asbestos cannot be combusted and is essentially chemically inert, a permanent remedy as such cannot be effectively implemented at this site. Therefore this remedy becomes the only currently feasible remedy under CERCLA for asbestos at this site.

Because this remedy will result in hazardous substances remaining on site above health-based levels, a review will be conducted bi-annually for the first five years after initiation and of remedial action and yearly thereafter, and this complies with the requirement for review set forth in Section 121(c) of CERCLA, 42 U.S.C. Section 9621(c).

9-30-88
Date

Stanley L. Laskowski,
Acting Regional Administrator
EPA Region III

Summary of Remedial Alternative Selection for the Ambler Asbestos Site

Site Name, Description, and Location

The Ambler Asbestos Piles site is located in the southwestern portion of the Borough of Ambler, Montgomery County, Pennsylvania (see Figures 1 and 2). The site is bordered on the west by the Wissahickon Creek and its floodplain; on the northwest by Butler Pike, a major transportation route; on the north by Locust Street; and on the southeast by Church Street. A portion of the site extends westward from Ambler into Upper Dublin Township, Montgomery County. The Ambler Asbestos Piles Site consists of the Locust Street Pile, the Plant Pile, the Pipe Plant Dump, and the asbestos settling basins/filter bed lagoons Nicolet Inc. is the current owner of the Locust Street and Plant Pile, and the asbestos settling basins/filter bed lagoons. CertainTeed Corporation is the owner of the Pipe Plant dump.

The waste piles of concern in this operable unit are referred to as the Locust Street Pile and the Plant Pile. These piles contain spent magnesium/calcium carbonate and waste from the manufacture of asbestos products. The primary contaminant of concern at the site is asbestos.

Within a quarter mile radius of the Locust Street Pile are approximately 40 residential dwellings and a public playground that was closed in 1984. The center of the Borough of Ambler lies approximately a half mile north of the Locust Street Pile and the adjacent Plant Pile. A low density housing development lies to the southwest of the Locust Street Pile separated by the Wissahickon Creek and its floodplain in Whitemarsh Township, Montgomery County.

Individual discussions of the Locust Street Pile, Plant Pile and filter bed lagoons, along with the Pipe Plant Dump are presented in the following subsections.

A. Locust Street Pile

The Locust Street Pile is approximately 1200 feet long and 300 feet wide and averages 50 feet in height above grade. According to the topographic map developed prior to the Removal Action in 1984 (Figure 3), the Locust Street Pile ranges in elevation from approximately 240 feet above Mean Sea Level (MSL) at the top of the southwestern portion of the pile to 170 feet above MSL at the base on the western side of the pile adjacent to the Wissahickon Creek. The western side of the pile is adjacent to Wissahickon Creek.

The Locust Street Pile side slopes range from 2.5:1 to 2.0:1 (horizontal:vertical) on the north, east and south, and from 1.6:1 to 1.4:1 on the west. Slope lengths (angular) are roughly 75 to 100 feet on the west and east and 25 to 75 on the north and south. The top of the pile is a relatively flat (0-3% slope) area which comprises approximately 20 to 25 percent of the total pile (crest) area. a relatively flat (0-3% slope) area which comprises approximately 20 to 25 percent of the total percent of the total pile (crest) area.

A report prepared by Johnson and Schroder of the University of Pennsylvania in 1977 for Nicolet Inc., stated that disposal for asbestos began waste in the 1930's at the Locust Street Pile Site. Disposal of general manufacturing waste may have begun earlier than the 1930's since the manufacturing of pharmaceutical and asbestos products at the site began in 1890's. The report stated that a quarry had existed at the Locust Street site prior to the disposal of wastes, but our investigation did not support its existence.

Products manufactured in the 1930's includes asbestos cement piping and shingles that required magnesium carbonate (magnesia) as a raw material. The process of extracting magnesia from dolomitic limestone produced 30 to 40 tons of carbonate waste per day. Once the quarry was filled (with spent magnesium carbonate), cinders and slag from the boiler plant were used to construct berms to contain the carbonate slurry. It was also reported in the Johnson and Schroder report that dumping of the carbonate waste on the northwest portion of the pile terminated in the early 1940's. Aerial photographs of the Locust Street Pile from 1950, 1964, and 1972 demonstrated continued dumping on this northwest portion (plateau area) of the pile until the late 1960's.

Deposition of wastes in the southern portion of the Locust Street Pile as reported by Johnson and Schroder began at the same time as the northwestern portion but received primarily cinders and bad production runs of piping, shingles, and millboard. Dumping on the southern portion of the Locust Street Pile was reported to have ceased in the late 1960's.

Analysis of waste samples taken from depths of 10-47 ft. below the surface detailed in a University City Science Center report, "Possible Health Hazards of Asbestos Waste Piles: Ambler, PA", (1975) indicate the carbonate waste consists of 70-85 percent calcium carbonate and 8-16 percent magnesium carbonate. Analysis for asbestos was not performed at that time. Surface samples taken by EPA's Emergency Response Team (ERT) and the Technical Assistance Team (TAT) in 1983 prior to the Removal Action from the Locust Street Pile indicated the presence of both types of asbestos and in significant concentrations predominantly on the large plateau area of the pile (Amosite 35-40% and Chrysotile 0-8%). Amosite asbestos fibers were primarily detected in samples taken from the side slopes of the Locust Street Pile at concentrations of 0-5 percent. Chrysotile was also found at concentrations of 2-10% in two of the ten samples taken of the exposed side slopes.

B. **Plant Pile**

The Plant Pile is approximately 650 feet in length and 600 feet in width. According to the 1984 topographic map (Figure the Plant Pile ranges in elevation from approximately 240 to 179 feet above MSL. The side slopes of the Plant Pile range from 2.0:1 to 1.7:1 (horizontal: vertical) on the north, 1.7:1 to 1.4:1 on the east, and 1.4:1 to 1.2:1 on side slopes of the Plant Pile range from 2.0:1 to 1.7:1 (horizontal: the south and west. Slope lengths (angular) are roughly 50 feet on the south, 100 feet on the east and west, and 120 feet on the north. The relatively flat (0-3% slope) area at the crest comprises approximately 40 to 45 percent of the Plant Pile area.

The Plant Pile is located southeast of the process plant and the asbestos filter bed lagoons. Disposal of wastes, beginning with calcium carbonate and magnesium hydroxide waste, was initiated on the Plant Pile in 1940's after the capacity of the Locust Street Pile was nearly reached (Johnson & Schroder, 1977). The carbonate waste was deposited as a slurry and contained by berms constructed of cinders and pumice rock. It was further reported that prior to 1964 a paper machine contributed some process waste. Aerial photographs of the Plant Pile from 1950 and 1958 demonstrate both a white and light gray slurry was pumped onto the Plant Pile. The aerial photographs of the Plant Pile from 1964, 1971, and 1978 show a change in the material deposited on the pile. The material deposited during this time was much darker than the material from previous photographs but was still being deposited as a slurry. From 1970-1975 it was reported that an asbestos cement sludge was pumped onto the Plant Pile. From 1975-76 asbestos millboard and the monolithic product process waste was pumped as a slurry to the Plant Pile. Continuous dumping was reported to have ceased in 1976; however, aerial photographs from 1978 and 1981 indicate continued activity on the Plant Pile.

C. **Asbestos Settling Basins/Filter Bed Lagoons**

The asbestos settling basins and filter bed lagoons are located between the Plant Pile and the Locust Street Pile. The settling basins and filter bed lagoons received process wastewater from the original manufacturing facility owned by Keasbey and Mattison Company (K&M). After the plant was purchased by Nicolet Industries, Inc. (now Nicolet Inc.) in 1962, the basins and lagoons continued to receive wastewater from processing and cooling operations. The two primary operations which reportedly contributed to the asbestos waste entering the filter bed lagoons are the millboard machines and the monolithic press. Based on aerial photography, the sludge from the lagoons was apparently dumped on the Plant Pile until 1978-79 via a pipeline. The lagoons received process wastewater, but the sludge was hauled off-site for disposal. Both the millboard machines and the monolithic press operations have been taken out of operation.

The only processed wastewater received as of the date of this document is non-contact cooling water from the sheet gasket machines, so little if any sludge should be produced. The most recent operational information concerning the wastewater management program, provided by Nicolet Inc., is dated July 25, 1979.

Beginning in 1973, the Pennsylvania Department of Environmental Resources (PADER) ordered Nicolet to stop dumping on the waste piles. This directly included the sludge from the filter bed lagoons. Nicolet maintains that in 1979 they installed a pelletizer unit to reduce solids entering the lagoons.

Based on information provided in the National Pollutant Discharge Elimination System (NPDES) permit application filed by Nicolet, Inc. on July 1, 1982, flow to the lagoons is 0.626 Million Gallons Per Day (MGD) and originates from the operations shown in the flow diagram in Figure 5. The primary water contaminant reported at that time was asbestos which originated from the millboard and monolithic press operations. Other potential contaminants that were identified on the application as "believed to be present" were chlorine, nitrogen (total organic), and surfactants. Wastewater from boiler blowdown and solvent recovery decant water is currently discharged to the Ambler Waste Water Treatment Plant (Ambler WWTP). The decant water contains methanol and toluene. Discharge of these waste streams to the Ambler WWTP began in 1980. Prior to this time, however, these process flows were also apparently discharged into the lagoons as evidenced by residual organic odor detected emanating from the lagoons by EPA and the Remedial Investigation (RI) investigation team during the site visits for the studies.

D. **Pipe Plant Dump**

Adjacent to the Plant Pile, there is a previous dump site identified as the "Pipe Plant Dump." This pile reportedly received primarily asbestos-containing solid pipe scrap from 1962 to 1974. The Pipe Plant Dump was covered and vegetated in 1974 by the owner (CertainTeed Corporation). The Pipe Plant Dump is not currently part of this Record of Decision (ROD). The Pipe Plant Dump is part of the site on the National Priorities List (NPL) and therefore requires an RI/FS Remedial Investigation/Feasibility Study (RI/FS) to complete an Endangerment Assessment of this Pile. An RI is currently being conducted by CertainTeed Corporation, the Potentially Responsible Party (PRP) for the Pipe Plant Dump. A second ROD will be issued in the future for this second operable unit.

On November 11, 1985, the CertainTeed Pile was inspected by U.S. EPA, PADER, the REM II team, and CertainTeed Corporation. The cover on the pile was found to be in good condition and well vegetated. Little evidence of erosion and scouring along the south side by the unnamed tributary was observed. Surface water samples from the unnamed tributary were taken by the EPA

FIT team on May 12, 1986 which verified that no contaminants of concern are migrating from this source.

Site History

The K & M Company owned the site from the late 1800's to 1962. The company initially operated as a pharmaceutical company until 1897. The cornerstone of the K & M venture was milk of magnesium hydroxide. The primary material used in the manufacture of milk of magnesia is magnesium oxide. The plant was located in Ambler due to the close proximity of large reserves of dolomite from which the magnesia was extracted.

Asbestos products were produced by K & M from 1897 to 1962. These included paper, millboard, electrical insulation, brake linings, conveyor belt, and high pressure peckings (rubber and asbestos).

The primary wastes generated at that time were spent magnesium/ calcium carbonate (generated by the process of extracting magnesium carbonate from dolomite limestone) and asbestos process waste including bad manufacturing runs and off-specification products. Although, it was reported (Johnson and Schroder, 1977) that disposal activities did not begin on the Locust Street Pile until the 1930's it is suspected that K & M used the former quarry area (Locust Street Pile) to dispose of their wastes.

During World War II, the K & M Plant became one of the leading producers of asbestos products. During the period in which K & M operated the plant, the Locust Street and Plant Piles received much of the total volume of waste materials that were deposited on the piles. Aerial photographs of the site from 1950 prior to K & M selling the facility, indicate that approximately 80 percent by surface area of the Locust Street Pile was present. The northwestern portion of the pile was still active in 1950 receiving a calcium carbonate slurry contained by berms constructed of cinders. The southern portion of the pile did not appear active in 1950.

Based on the 1950 aerial photographs, the Plant Pile was approximately 60-70 percent complete and continued to receive primarily carbonate waste. Since 1950, wastes were deposited on the top of the piles contained by berms that were continuously built up to contain additional waste.

By 1958 there were indications of continued activity on both the Locust Street and Plant Piles. Additional material in the form of gray slurry has been pumped on the large plateau area of the Locust Street Pile. A large quantity of calcium/magnesium carbonate slurry was also deposited on the Plant Pile since 1950 as evidenced by aerial photographs. No activity was evident on the Pipe Plant Dump.

In 1962, CertainTeed Corporation, a manufacturer of construction materials, purchased a portion of the site and plant facilities from K & M, including the pipe manufacturing plant and THE Pile. Thereafter, CertainTeed manufactured asbestos-cement pipe at the plant. Nicolet Industries, Inc., a manufacturer of building and automobile supplies, purchased the remaining plant facilities along the Locust Street Pile, the Plant Pile, and the asbestos filter bed lagoons.

The aerial photograph of the site taken in 1964, following the purchase of the Locust Street and Plant Piles by Nicolet Industries, Inc., indicate disposal activity on the plateau areas of both piles since 1958. Wastes were apparently being deposited as a slurry but were dark gray and black in color compared to the white and light gray color of the waste in the previous aerial photographs. It appears then that the wastes deposited on the piles following the purchase of the site by Nicolet changed from primarily calcium/magnesium carbonate to process waste from the asbestos millboard and monolithic product manufacturing. This darker material may be sludge from the filter bed lagoons.

The 1964 photographs also shows the deposition of wastes on the CertainTeed Pile that included), asbestos-cement shingles, acoustical products and asbestos-cement piping. The wastes deposited were solids consisting of off-specification piping and process waste from the asbestos-cement pipe manufacturing facility.

The aerial photograph of the site nine years after the purchase of the Locust Street and Plant Piles by Nicolet Inc. indicate that disposal on the Locust Street Pile ceased sometime after 1964. Vegetation was evident on the two large plateau areas of the northwestern portion of the Pile and trees had grown along the slopes of the southern portion of the pile where no activity had been identified since 1950. Conversely, dark flow patterns on the Plant Pile indicated continued disposal of wastes. Trees were subsequently noted on the Plant Pile in 1971.

PADER and EPA became actively involved with the site in 1971, when a complaint was lodged with EPA by the Executive Director of the Wissahickon Valley Watershed Authority. From November 21, 1971 to January 18, 1972, a field survey water and air contamination at the site was conducted by EPA. Visible emissions were noted and substantial dust concentrations were measured and attributed to asbestos contamination.

In December 1971, Nicolet Industries, Inc. applied for approval to continue to dump on the Plant Pile. While this application was pending they continued to dump. Aerial photographs of the site from 1978 indicate continuous disposal on the Plant Pile since 1971. In 1973, PADER ordered Nicolet to stop dumping and to cover and stabilize the Plant Pile. Nicolet then applied for a solid waste management permit.

In February 1974, PADER issued an order to both Nicolet and CertainTeed concerning the termination of disposal operations. Shortly thereafter, CertainTeed Corporation discontinued its operations at the site, covered and vegetated the CertainTeed Pile, and moved operations out of the region; CertainTeed still retains ownership of the pile. Nicolet, however, appealed the PADER order and was subject to a subsequent order by PADER to cease its solid waste disposal. Nicolet continued dumping until 1980.

Aerial photographs of the site from 1984 showed a different flow pattern in the deposited waste on the Plant Pile than the 1978 photograph. In November 1978, amid increasing national concern about asbestos and other industrial wastes, EPA placed the Ambler site on a list of regulated asbestos sites pursuant to National Emissions Standards for Hazardous Air Pollutants (NESHAPS).

On June 2, 1983 the EPA's FIT team conducted a sampling program of the Locust Street Pile that included surface water, bulk waste samples and air samples. The results of the sampling program revealed downstream concentrations (260 MFL) of chrysotile fibers to be 10 times greater than the upstream concentrations (18 MFL). Bulk samples from the Locust Street Pile contained up to 30 percent chrysotile asbestos fibers and 3 percent amosite fibers. On September 15, 1983, U.S. EPA Region III On-Scene Coordinator (OSC) tasked the Technical Assistance Team (TAT) to conduct an assessment at the asbestos waste piles at the Nicolet, Inc. property. During the investigation, the TAT team observed steep, unvegetated and eroded slopes.

On September 27, 1983, the initial site assessment was conducted by the EPA Emergency Response Team (ERT), the PADER and the TAT. Air samples, bulk surface samples, and wipe samples from the playground equipment adjacent to the asbestos waste piles were collected. The samples were analyzed for asbestos and tested positive in the bulk surface samples and in the wipe samples. As a results these findings, the Centers for Disease Control (CDC) issued a Public Health Advisory recommending the closure of the playground. The OSC submitted a Request for Emergency Funding to initiate actions to alleviate the health risk caused by the piles.

On December 15, 1983, in accordance with CERCLA Section 104 and Section 300.65 of the NCP, EPA determined that the site posed an imminent and substantial danger to the public health and welfare and made the decision to proceed with an emergency response action. EPA requested that Nicolet cover the piles. However, Nicolet replied that it would not comply with the specific terms outlined by EPA.

District of Pennsylvania issued an order allowing EPA access to the Nicolet site in order to perform an emergency response action pursuant to Section 104 of CERCLA.

The EPA proceeded to implement the emergency response actions at the site, which included:

- Covering the Locust Street Pile with six to eighteen inches of soil;
- Stabilizing the covered slopes with erosion control netting;
- Hydroseeding the Locust Street Pile to minimize erosion;
- Installing a drainage system for the Locust Street Pile and;
- Dismantling and removing the Locust Street playground.

Covering of the Locust Street Pile was completed on July 22, 1984. EPA completed all drainage work, erosion control, and fencing by October 12, 1984. Upon completion of these tasks, EPA sampled several neighborhood homes for asbestos fibers and reported that nearby homes had not been contaminated by asbestos fibers during activity at the site. This latter activity was completed May 21, 1985.

In an independent effort, Nicolet began covering the Plant Pile on or about April 16, 1984, and completed the effort on June 1, 1984.

A site visit conducted by EPA on April 1, 1985 revealed erosion of the cover of the Plant Pile, while the Locust Street Pile was intact. EPA, Nicolet, and the REM II team personnel conducted joint initial site inspections on June 3 and June 11, 1985 to determine the scope of any required initial measures. It was recommended that the former playground area be landscape maintained for aesthetic, and vermin and insect management purposes.

In March 1985 EPA initiated the Workplan for the Remedial Investigation and Feasibility Study. The Study was completed August 1988.

CHRONOLOGY

Dates	Event
1890's	K & M Company started manufacturing products and disposed of pharmaceutical and asbestos waste adjacent to the plant in Ambler, PA.

Dates	Event (Cont.)
Early 1930's	Waste disposal at the Locust Street Pile was ongoing. The majority of the waste disposed on the pile consisted of carbonate residues from the processing of dolomitic limestone for the extraction of magnesia. The waste, in the form of a slurry, was added to the pile at a rate of 30 to 40 tons per day.
Early 1940's	Waste disposal at the Plant Pile began. Wastes disposed of from 1933 to 1962 included primarily a calcium carbonate slurry and later process waste from the asbestos paper machine operation.
1962	Nicolet Industries Inc. purchased most of the K&M facility including the Locust Street Pile, Plant Pile and filter bed lagoons. CertainTeed Corporation purchased the pipe manufacturing plant and the Pipe Plant Dump. Both companies continued to dump their wastes that consisted mostly of asbestos process waste and off-spec asbestos products.
3/71	NESHAP listed asbestos as a hazardous air pollutants.
11/15/71	EPA Region III received a complaint from the Executive Director of the Wissahickon Valley Watershed Authority about asbestos contamination of ambient air and the Wissahickon Creek, a tributary to the Schuylkill River.
12/2/71	Nicolet applied to PADER for a permit to continue using the piles for disposal of asbestos waste. Nicolet was required to have a permit under the PADER Solid Waste Management Act of 1968.
12/13/71	EPA field investigation started. Residents reported visual evidence of asbestos dust in homes and the playground on Locust Street whenever windy weather occurred. Also, surface water samples on the property indicated that waste streams leaving the CertainTeed and Nicolet Piles contained asbestos in excess of background concentration limits specified in 1971 Water Quality Criteria published by EPA in "Quality Cri-

Dates	Event (Cont.)
	teria for Water" (the Red Book). These criteria for asbestos were later replaced by criteria published in 45 F.R. 79318 (November 28, 1980).
1/3/72	Ambient air monitoring was initiated by EPA Region III. Field testing found 690 mg/m^3 and 270 mg/m^3 dust in ambient air at sites near the two plant locations, a great portion of which was attributed to asbestos presence.
3/2/72	CertainTeed applied to PADER for a permit to continue using the piles for asbestos waste disposal.
4/6/73	National Emissions Standards for Hazardous Air Pollutants (NESHAPS) for asbestos were promulgated by EPA with amendments proposed on 10/25/74 clarifying operation of waste disposal sites for asbestos. "No visible emissions" standard enacted for milling and manufacturing of asbestos products.
9/10/73	EPA Region III visited the asbestos piles at Nicolet and CertainTeed. Arrangements were made to sample ambient air over and around the piles.
10/22, 23, & 24/73	Ambient asbestos air monitoring was conducted. The following asbestos concentrations were recorded: - CertainTeed pile (114.5 ng/m^3) - Nicolet Pile (41-114 ng/m^3) - Nicolet settling lagoons (1,563 ng/m^3) - Locust Street playground (10 ng/m^3)
2/19/74	PADER issued an administrative order to Nicolet Industries and CertainTeed Corp. to cease dumping asbestos waste onto the piles. Pile access was limited and covering was ordered to be with material suitable for planting and growing vegetation. The piles were to be stabilized and water percolation and surface water management planned.
3/3/74	CertainTeed signed a consent order with PADER and agreed to follow PADER legal order of 2/19/74.

Dates	**Event** (Cont.)
4/17/74	PADER was told by Nicolet that they could not comply with PADER order of 2/19/74.
6/25/74	EPA proposed clarifying amendments to NESHAPS that regulate active and inactive sites for land disposal of asbestos wastes.
10/14/75	EPA promulgated clarifying amendments to NESHAPS that regulated active and inactive asbestos waste sites. 40 C.F.R. Section 61, Subpart M regulates the operation of waste asbestos dump sites. Waste collection and disposal included under "no visible emissions standard."
11/78	EPA placed the Ambler site on a list of NESHAPS asbestos sites among growing concern over the effects of asbestos.
3/79	EPA initiated a technical assistance program to help schools identify and control friable asbestos-containing materials.
6/83	NUS FIT sampling and testing performed on-site (air, waste, and water).
9/83	OSC, ERT, and TAT sampling and testing performed on-site (air, waste, and wipe samples).
12/83	The Centers for Disease Control issued a Public Health Advisory recommending, among other things, the closure of the playground located on the toe of the east side of the Locust Street Pile.
12/15/83	CERCLA fund authorization was obtained for an emergency response action at the site.
3/26/84	An emergency response action was undertaken which involved establishing a vegetated soil cover, placement of erosion control netting, and surface drainage system for the Locust Street Pile and playground site area. The playground was closed, dismantled and removed.
4/84	ERT sampling and testing performed (air).
9/84	ERT residential sampling performed (air and waste).

Dates	Event (Cont.)
10/84	Site proposed for inclusion on NPL.
5/85	REM II and EPA began RI/FS (Work Plan Phase) under CERCLA (Superfund).
6/85	REM II, EPA, and Nicolet conducted initial RI/FS site inspection.
10/85	Landscape maintenance of former playground area along Chestnut Street performed by a subcontractor to REM II.
11/85	CertainTeed Pipe Plant Dump (and other site areas) inspected by U.S. EPA, PADER, and the REM II team. Nicolet agreed to a partial records search by EPA and REM II, which was performed.
6/6/86	Site ranked 523 of 703 on the NPL.
9/3/86	Public meeting held at Ambler Borough Hall to present the RI/FS Work Plan.
9/ 30 - 10/2/86	A site inspection along with ambient air sampling, as part of the Designated Activities, was conducted by the REM II team.
12/29/86 - 8/21/87	RI field investigation conducted by the REM II team. Waste, cover soil, surface water, sediment, and ambient air samples collected and sent for analysis through EPA's Contract Laboratory Program (CLP).

Community Relations

During the removal action at the Ambler Asbestos site in 1984, EPA worked closely with Ambler Borough officials in disseminating information to the public. The residents who live on Locust Street the ones mostly interested in the site, since the playground that was their childrens' only recreation area had to be closed due to its close proximity to the asbestos piles.

On September 3, 1986 EPA held a public meeting to announce the start of the Remedial Investigation and Feasibility Study (RI/FS). During the months prior to the meeting, Borough officials became interested in the vitrification process by Vitrifix, Inc. to treat the asbestos piles. EPA met with the local officials at the beginning of the RI and assured them that the process would be reviewed along with other cleanup alternatives during the Feasibility Study (FS) phase.

An advertisement was placed in the Philadelphia Inquirer on May 31, 1988. The ad listed all of the cleanup alternatives and announced EPA's preferred alternative and started a 30 day public comment period for the proposed plan and RI/FS.

A public meeting was held on June 16, 1988 in accordance with Section 117(a)(2) of CERCLA, 42 U.S.C. Section 9617 (a) (2) and 40 C.F.R. Section 300.67 (d) with about 25 attendees in addition to Ambler Borough Council, PADER and EPA representatives. The residents requested EPA to place the site fence and signs as close to the piles as possible. The Mayor and Borough Council requested EPA to meet with other companies including Vitrifix, since the local officials are not in favor of EPA's containment alternative, and would prefer EPA look into other innovative technologies for remediating the asbestos piles.

The Borough Council and Nicolet, Inc. also asked EPA to extend the comment period thirty days. Originally EPA extended it only to July 13, then granted the request, ending the comment period on July 29. Another request for an additional three months came into EPA from Council. EPA did not extend the comment period, but did agree to meet with Borough officials on September 22, 1988. Ambler Borough Council invited their technical expert to the meeting. They asked that the Record of Decision not be signed so that their technical expert could look into other companies with innovative technologies for remediating the site. EPA explained that the signing of the ROD signifies that the containment alternative has been chosen, but the signing does not preclude the Agency from meeting with other companies with other innovative alternatives. A letter was sent to EPA Region III's Deputy Regional Administrator requesting delay of the ROD signing. That letter was received from the Ambler Borough solicitor on September 26, 1988.

As described above, EPA has met the public participation requirements of Sections 113 (K) (2) (B) and Section 117 of CERCLA, 42 U.S.C. Section 9617.

Contamination Problem

The ERT and TAT sampling and testing on and near the Ambler Asbestos Piles site demonstrated that asbestos fibers had migrated off the manufacturing site into adjacent public areas which included a neighborhood playground as evidenced by air, waste, and wipe sampling/analysis. The CDC issued a public health advisory closing the playground based on the evidence of air transport of asbestos fibers from the piles to areas where human contact could result from inhalation or ingestion, and an Immediate Removal Action was implemented in 1984.

The side slopes and some of the flat areas of the Locust Street and Plant piles are now covered as the result of the Removal Action by the EPA and an independent effort by Nicolet respectively. The large plateau areas of both piles remain uncovered. Portions of the slopes of the Locust Street Pile where large trees have grown are also exposed. Evidence of erosion and sloughing of the cover were evident on both piles during the RI. The currently exposed areas of both piles and/or future source areas of both piles exposed due to cover or slope failure create the potential for release of asbestos fiber to the ambient air that can be inhaled by local residents, and/or continued contamination of the adjacent surface water.

Physiography

The Ambler Asbestos Piles site lies within the Delaware River drainage basin. The area is characterized by relatively flat topography with occasional rolling hills with the greatest change in relief occurring along the flood plains of the many creeks and tributaries that flow through this area. Elevations within a mile of the site range from 160 to 300 feet above Mean Sea Level (MSL).

The site is located adjacent to the 100 year floodplain of Wissahickon Creek (see Figure 6). Wissahickon Creek flows along the western side of the Locust Street Pile. The 100 year floodplain along this side of the Pile reaches an elevation of 176 feet (MSL) or approximately 8 feet above the toe of the pile at creek's edge.

The Locust Street an Plant Piles rise above the natural grade 65 feet and 70 feet respectively, and therefore are a predominant feature in Ambler. The map view areas of the Locust Street and Plant Piles are approximately 422,000 square feet (9.7 acres) and 412,000 feet (9.5 acres), respectively (EPIC, June 1987). The estimated volume of these piles is approximately 464,000 cubic yards for the Locust Street Pile and 571,000 cubic yards for the Plant Pile (EPIC, June 1987).

Land Use

Land uses around the site included industrial, residential, commercial, and transportation. Figure 6 presents a land use map of the site and the area within 0.5 miles of the site based on zoning maps from Ambler Borough, Upper Dublin Township and Whitermarsh Township. Figure 7 depicts various land uses within an approximate 1.2 mile radius of the site based on land use identification using remote sensing data (EPIC, June 1987).

The Ambler Asbestos Piles site occupies approximately 22.6 acres of an industrial zoned area along the southwest border of the Ambler Borough line. Residential housing is located immediately northwest of the Locust Street Pile and approximately 500 feet east and west of the Plant Pile. Numerous educational and recreational facilities are located within 1.2 miles of the site. Agricultural land is located approximately 2,000 feet to the west (EPIC), June 1987.

Building and Structures

There are number of significant structures in the vicinity of the waste piles. In the Nicolet manufacturing area there are four major buildings housing various offices and production processes, as well as related structures for waste treatment, storage, and shipping. South of Wissahickon Avenue between Chestnut and Locust Streets are a number of row houses and single family homes. North of Wissahickon Avenue are a number of commercial and light-industrial establishments. The playground adjacent to the Locust Street Pile has been closed and all equipment removed.

Commuter rail tracks run parallel to Maple Street east of the Plant Pile and the Nicolet plant site.

Potential Receptors

There are a number of potential receptors within the vicinity of the waste piles. The nearest residence is within 200 feet northeast of the Locust Street Pile, and an estimated 6,000 persons live within 1/2 mile of the site.

The Nicolet manufacturing area is adjacent to the Plant Pile, Locust Street Pile and lagoons. In addition, there are number of commercial and lightindustrial establishments just north of Wissahickon Avenue within a few hundred yards of the site.

The Central Business District of Ambler is located approximately onehalf mile northeast of the waste pile and lagoons.

1. **Air Quality**

The Ambler Asbestos Piles Site is located in the Metropolitan Philadelphia, Interstate Air Quality Control Region (U.S. EPA, July 1985). This region is classified as an attainment area for all criteria pollutants except photochemical oxidants (precursors to ozone). The air quality within the air basin containing the Ambler Asbestos Site meets the national standards for sulfur dioxide (SO_2) and meets or exceeds the national standards for total suspended particulates (TSP). It cannot be classified as exceeding the national standards for both carbon monoxide (CO) and nitrogen dioxide (NO_2). The entire State of Pennsylvania does not meet the standard for ozone (O_3). Locally, air quality is potentially impacted by industrial and private sources.

II. Biological Resources

A. Terrestrial Resources

The Ambler Asbestos Piles site does support a significant terrestrial habitat on the covered waste piles. Crown vetch that was planted during the 1984 Immediate Removal action has flourished to provide then majority of the present vegetative cover on the waste piles. A variety of grasses and shrubs as well as young to mature trees are also supported in areas of the piles. The developed cover provides cover and habitat for species present in the surrounding area.

A variety of birds (hawk, pheasant, Canada geese, mallard duck, songbirds, and crowns) utilize the area for foraging and nesting purposes. Deer have been sighted on the Locust Street Pile. Other wildlife that have been sighted include racoons, ground hogs, muskrat, skunks, and squirrels.

Burrows have been observed on several slopes of the Locust Street and Plant Piles. The burrows extend into the cover and into the waste materials. Burrowing animals have caused minor problems in the re-exposure of waste materials at several locations on the piles.

B. Aquatic Resources

Wissahickon Creek runs along the south and west sides of the Locust Street Pile. The creek contributes to the Schuylkill River from which public water supply is taken 12 miles downstream of the site. Fauna supported in the Wissahickon in the vicinity of the site include sunfish, minnows, and eels. Wissahickon Creek is stocked annually with trout downstream of the site at Fort Washington State Park. The stream is fished from spring to summer. Most of the trout do not survive the summer due to high temperature and low dissolved oxygen in the stream.

III. Geology

The site study area is underlain by bedrock of the Stockton Formation of Triassic age. The Stockton Formation is described by Barksdale (1958) as consisting of light-colored, coarse-grained, arkosic sandstone and conglomerate; red to brown fine-grained siliceous sandstone; and red shale. The reddish arkosic units are the most characteristic of the Formation, especially the lower members of the Stockton Formation that underlie the site. Individual layers within the Stockton Formation commonly pinch out or grade into beds of different texture or mineralogy, and rarely can be traced for any significant distance. Sequences of beds, however, may persist for several miles. A geologic map of the Ambler United States Geologic Survey (USGS) quadrangle is presented in Figure 8.

The Stockton Formation crops out in an east-northeast trending band approximately five miles wide in the Ambler area. Bedding strikes northeast and dips to the northwest at 10 to 20 degrees. Bedding plans commonly show ripple marks, mud cracks, raindrop impressions, cross bedding, and pinch and swell structures. The thickness of the unit ranges from 1,000 to 5,000 feet and probably averages about 3,000 feet near the site. The Formation is extensively faulted and is cut by at least two sets of vertical joints, one parallel to strike and one at about a 50 degree angle to strike.

Weathering of the Stockton Formation generally results in deposits of sandy clay loams of vairable thickness that form an undulating topography of moderately low relief. Valleys are typically eroded into the softer sandstone beds while uplands are more commonly underlain by the arkosic beds. The depth of bedrock in the study area has been estimated to be less than 10 feet (Preliminary Assessment/Site Investigation, NUS, 1983). However, it has been reported that quarry activities may have occurred under the Locust Street Pile (Johnson and Schroder, 1977).

IV. Hydrology

A. Ground Water Hydrology

Ground water flows in the Stockton Formation through both primary intergranular openings as well as secondary joints and faults. Flow direction is locally quite variable and hydrologic boundaries are frequent. In general, regional ground water flow is either along the strike of the formation or down dip. To a great extent, the occurrence and movement of ground water in the Stockton Formation is controlled by the configuration of the base of the weathered zone and by vertical changes in the permeability of the deposits (Barksdale et al., 1958). In the vicinity of the waste piles, ground water flow is expected to be toward Wissahickon Creek. Shallow flow is likely to be unconfined while deeper ground water is under artesian or semi-artisian conditions. The depth to ground water has been reported to be less than 5 feet in this site area.

Aquifer tests in the Stockton Formation (semiartisian deeper ground water) indicate that the unit is one of the best sources of ground water in southeastern Pennsylvania. Transmissibility ranges from 1,000 to 35,000 gallons per day per foot (gpd/ft) with typical values between 5,000 and 9,000 gpd/ft. The storage coefficient ranges from 0.0001 to 0.000001 indicating a range of conditions from semi-artisian to true artesian. Well yields range from 1 to 900 gallons per minute (gpm) with typical values from 50 to 100 gpm. Specific capacity varies from 0.35 to 44 gpm/ft with a median value of about 6 gpm/ft (Barksdale et at., 1958; R. E. Wright Associates, Inc., 1982).

Water quality in the Stockton Formation is generally good but is highly variable depending on local hydrogeologic and land use conditions: Typical values of water quality parameters are: iron, 0.10 mg/l; manganese, 0.04 mg/l; bicarbonate, 84 mg/l; nitrate, 10 mg/l; sulfate, 24 mg/l; total dissolved solids, 150 mg/l; hardness, 100 mg/l; specific conductance, 250 micro-ohms/cm; and pH, 7.2 (R.E. Wright Associates, Inc., 1982). Water from the Stockton Formation is a primary source of drinking water for a number or private and public users including the Borough of Ambler.

Water supply for the site area is provided by the Ambler Borough Water Department through a series of nine supply wells. During the period from July through December 1983, individual supply wells pumped between 60 and 730 gallons per minute for a weekly total of between 1,500 and 2,400 gallons per minute. The municipal well nearest to the water piles is approximately 0.4 miles east of the Pipe Plant Dump. This well is 500 ft deep, and pumps roughly 100 gpm (NUS, 1983). The nearest known private (residential drinking water) well is the Burke well.

B. <u>Surface Water Hydrology</u>

The major surface water body in the area is Wissahickon Creek, which flows southeast at a gradient of roughly 22 feet per miles. The creek and its flood plain from the southern and western borders of the site. Prophecy Creek and several unnamed easterly flowing tributaries empty into Wissahickon Creek west (upgradient) of the site.

Surface drainage from the waste piles and the manufacturing areas flow to Wissahickon creek via storm sewers and small surface channels. Two borough storm sewers run underneath the Locust Street Pile. One of these pipes discharges into a drainage ditch west of Nicolet's filter beds and subsequently into the drainageway from the lagoons that flow into the Wissahickon Creek. The other large outlet (5' x 5' box culvert) is located just below the filter bed lagoons and discharges directly into the drainageway at the same point as the filter bed lagoons. No seeps were observed on the slopes of the Locust Street Pile and Plant Piles. White milky seeps were observed at the toe of the western side of the Locust Street Pile that run along the Wissahickon Creek. Bedrock outcrops at this toe. The seeps were observed coming from the interface of the bedrock and overburden.

The flood plain of Wissahickon Creek is a ground water discharge zone and several permanent and seasonal springs have been reported in the area. No specific data exists on the water quality or the rates of discharge of the springs.

Public Water Supply

Water supply for the site area is provided by the Ambler Borough Water Department through a series of nine supply wells. The municipal well nearest to the waste pile, Well No. 9 on Figure 9 is approximately 0.4 miles east of the Pipe Plant Pile. This well is 500 ft deep, and pumps roughly 100 gpm (NUS, 1983). Other municipal wells in the area are Well No. 4, which is 305 ft. deep and pumps at an average rate of 75 gpm, and Well No. 11, which is 500 feet deep and pumps at a rate of 100 gpm. All well water is pumped into common storage tanks. The only reported treatment to the water is the addition of chlorine. The water is tested periodically for total solids, color, odor, turbidity, sediment, pH, minerals, fecal coliform, chlorination by-products and volatile organics.

The nearest public water intake from surface waters is located approximately 12 miles downstream of the site on the Schuylkill River about one half mile downstream of the confluence of Wissahickon Creek and the Schuylkill River. Figure 10 is a flow diagram indicating how this water is treated based on conversations with the operators in December 1987. Both the flocculation and the rapid sand filtration treatment unit should remove most asbestos, if any is present in the water. Because of the treatment the water receives and the dilution that occurs when Wissahickon Creek flows into the Schuylkill River, asbestos would not appear to be a problem in the water from this intake.

Ground water is not expected to be a significant migration pathway for asbestos at this site. This is due to two factors: 1) the site's location in a hydrologic discharge zone where generally base flow is slightly upward and toward the stream; and 2) the relative insignificant subsurface downward or lateral migration of asbestos fibers in soil. To date, there is no documentation of ground water transport of asbestos particles (Dalton, U.S. EPA, 1985).

Field Investigation and Analytical Program

The field investigation and analytical program was designed to determine if potential public health risks and environmental impacts still exist at the Ambler Asbestos Piles site and if remedial action is needed in accordance with 40 C.F.R. Section 300.68 of the NCP. In order to complete the Endangerment Assessment the following Remedial Investigation/Feasibility Study objectives were identified:

- Locate immediate and/or potential future sources of asbestos release by identified pathways of migration (surface water, air) which can reach sensitive receptors resulting in public health risks and environmental impacts. This includes analysis of whether exposed asbestos could produce unacceptable risks to persons on-site by direct contact (either via authorized or unauthorized site entry);

- Identify contaminants other than asbestos that may pose an immediate or potential risk to public health and/or the environment;
- Determine whether the site is securely closed as a result of the previous "Removal Actions" (i.e., no pathways for asbestos or other contaminant release are found in quantity or concentration that pose a risk to human health or the environment).

Previous field investigations and studies have addressed the first objective, however, they were conducted prior to the 1984 Removal Action. This field investigation and analytical program was designed to address the objectives with regard to post-Removal Action site conditions. The investigation focused on addressing the following data gaps, in order to meet the RI/FS objectives:

- The content of the piles and especially the degree of asbestos containing materials within and up to 100 feet from the identified waste piles and lagoon area;

- An assessment of the condition, thickness, and long-term life of the cover materials over the two identified asbestos and process waste piles;

- Data on the physical/structural characteristics (shear strength, moisture content, consolidation properties) and material distribution of the piles;

- An evaluation of the present and future slope stability and potential settlement of the waste piles, as well as other on-site physical features that would affect contaminant migration, containment, and/or cleanup;

- The presence of asbestos in the sediments and surface waters at and adjacent to the site after the Removal Action;
- The present and potential impacts on the adjacent Wissahickon Creek;

- Information on background levels of asbestos in ambient air in Ambler and the surrounding area including the level of asbestos in the ambient air up and down gradient of the site after the Removal Action.

- The presence of contaminants other than asbestos at concentrations which pose a risk to human health and/or the environment.

These data gaps were organized into task objectives from which the phased field investigation was developed. Table 1 presents an outline of the phased Field Investigation Program. The task objectives listed in Table 1 relate to the tasks under each phase.

A phased approach was utilized to identify potential areas requiring further investigation and testing at an early stage. Phase I was performed in three subphases; site survey, non-intrusive sampling and intrusive sampling. Greater safety measures were employed during the intrusive sampling. Air monitoring was performed throughout the survey and sampling programs. An additional phase (Phase 2) was to be performed if contaminants of concern other than asbestos were found at concentrations that pose a potential health and/or environmental risk. A phase 2 program was not implemented based on the analytical results from waste sampling at the Locust Street and Plant Piles.

Description of Major Potential ARARs

An ARAR, as defined, is an environmental law, regulation, or guideline that is either "applicable" or "relevant and appropriate" to a remedial action. "Applicable" requirements are those cleanup standards, standards of control, and other environ mental protection requirements, criteria, or limitations, promulgated under Federal or State laws that specifically address chemicals/contaminants of concerns, remedial actions, locations of remediation, or other circumstances at a CERCLA-regulated site. "Relevant and appropriate" requirements are those which address problems or situations sufficiently similar to those encountered at a CERCLA-regulated site that their use is well suited to the particular site (Section 121 of CERCLA, 42 U.S.C. Section 9621 and 40 C.F. R. Section 300.68(i)).

ARARs can be divided into the following categories:

- Chemical/contaminant-specific requirements - Health or risk-based concentration limits or ranges in various environmental media for specific hazardous substances, pollutants, or chemicals/contaminants. These limits may take the form of cleanup levels, discharge levels and/or maximum intake levels (such as for drinking water and breathing air for humans).

- Action-specific requirements - Controls or restrictions on particular types of remedial activities in related areas such as hazardous waste management or wastewater treatment.

- Location-specific requirements - Restrictions on remedial activities that are based on the characteristics of a site or its immediate environment. An example would be restrictions on wetlands development.

This section describes the chemical/contaminant-specific ARARs which relate to the Ambler Asbestos Piles Remedial Action. The action specific requirements will be discussed under the development of remedial alternatives. There are no location specific requirements for this site.

A review of various potential chemical/constituent specific requirements and the determination of which may be applicable, relevant, or appropriate to the Ambler site RI was conducted. The results are discussed in the remainder of this section.

Summary of Asbestos-Related ARARs

While asbestos has been used in industry for a long time, the regulation of asbestos is a relatively recent development. Most of the significant asbestos regulations were promulgated in the last 15 years; additional regulations will probably be introduced in the next few years.

The areas covered by the existing regulations include:

- Control of air emissions from industrial sources; and
- Air concentration limits for workers during abatement work and in schools;

A summary of the existing asbestos regulatory limits or goals is presented in Table 2. A category of existing guidelines will be discussed in a "To be Considered" section below.

The current regulations do not address either limits for asbestos concentrations in ambient air or asbestos concentrations in wastewater effluent. Most of the regulatory effort to date has been focused on occupational exposures in industrial and educational settings. The development of guidelines for the general population has moved less rapidly due to the complexity of sampling, analyzing and interpreting asbestos concentrations in ambient air. The existing regulations and occupational health studies can however be used as a guideline in evaluating the quality of ambient air and water at the Ambler site.

A brief discussion of potential applicable or relevant and appropriate asbestos regulations is presented in the following subsections.

- 40 C.F.R. Part 61, Subpart M -- National Emission Standards for Hazardous Air Pollutants.

Section 112 of the Clean Air Act, as amended, 42 U.S.C. Section 7412, requires that National Emission Standards for Hazardous Air Pollutants (NESHAPs) be set for hazardous air pollutants. The National Emission Standards for asbestos (Subpart M of 40 CFR Part 61) include standards for a variety of asbestos manufacturing, construction, and disposal operations.

Of particular relevance to the Ambler site is Section 61.153, "Standard for Inactive Waste Disposal Sites for Asbestos Mills and Manufacturing and Fabricating Operations." Each owner or operator is required to comply with one of the following:

- Either discharge no visible emissions; or
- Cover the waste material with at least 6 inches of compacted non-asbestos containing material, and grow and maintain a cover of vegetation; or
- Cover the waste material with at least 2 feet of compacted non-asbestos contacting material (no vegetation required); or
- Apply a dust suppressant that binds the dust and controls wind erosion.

The rules also include requirements for fencing, posting of warning signs, and long term monitoring involving visual inspection of the site for emissions.

TABLE 2

SUMMARY OF ASBESTOS REGULATORY LIMITS OR GOALS

MEDIUM	REGULATION	AGENCY	REGULATORY LIMIT OR GOAL
Air	40 CFR 61	EPA	No visible emissions to outside air.
	40 CFR 763	EPA	2 (fibers/cubic centimeter) by PCM (8 hour time weighted average) for asbestos abatement worker exposure. 0.02 f/cc TEM performance standard for remediation in schools.
	29 CFR 1910 and 29 CFR 1926	OSHA	0.2 f/cc by PCM (8-hr time weighted average) for industrial and construction worker exposure.
Water	45 FR 79318 (November 28, 1980)	EPA	Zero concentration in surface water for maximum protection of human health; drinking water concentration of 30,000 fibers per liter indicated to result in increased lifetime cancer risk 10^{-6}.

40 CFR 141	Proposed Maximum Concentration Level Goal (MCLG) of 7.1 million fibers per liter (fibers < 10 um) for drinking water.

40 CFR Part 763, Subpart G -- ASBESTOS ABATEMENT PROJECTS

Section 6 of the Toxic Substances Control Act (TSCA) provides EPA with the authority to control the manufacturing, processing, distribution, labeling, and disposal of chemical substances and mixtures. The regulations addressing asbestos under this Act are contained in 40 CFR 763. Subpart G of this rule, "Asbestos Abatement Projects," describes the requirements to be followed during asbestos abatement projects. The maximum 8-hour time-weighted average airborne concentration for any worker without protection in an abatement project is 2 f/cc (greater than 5 um size). The ceiling concentration is 10 f/cc (greater than 5 um size). Samples are collected on an 8 um filter using a high volume air pump and measured by Phase Contract Microscopy (PCM.)

Subpart E of this rule, "Asbestos-Containing Materials in Schools" sets requirements for remedial action in schools. It includes a standard for determining if further action is necessary after abatement. If the average concentration does not exceed the limit of quantification for the Transmission Electron Miscroscopy (TEM), no further action is required. The limit of quantification is defined as four times the analytical sensitivity. The analytical sensitivity is currently less than 0.005 f/cc of air. Thus, if the concentration is below 0.02 f/cc, no further quantification is required. Alternatively, if the average concentration is not significantly different than the outside concentration, no further action is required.

40 CFR Part 141 -- NATIONAL PRIMARY DRINKING WATER REGULATIONS

Section 1411-12 of the Public Health Service Act as amended by the Safe Drinking Water Act, 42 U.S.C. Sections 300 (g)-(g)(1), provides for the development of Maximum Contaminant Levels (MCLs) in drinking water. Under this rule, Maximum Concentration Level Goals (MCLGs) are to be initially developed, which are non-enforceable goals based entirely on health considerations. The MCLs represent enforceable drinking water standards which are to be set as close to the MCLG as is realistically feasible. MCLs are based on health, technical feasibility, and cost-benefit analysis. A MCLG for asbestos in drinking water of 7.1 million fibers per liter (MFL) for fibers greater than 10 um was proposed by EPA in 1985 based on an increased lifetime cancer risk level of 1 x 10-6. As of April 1988 an accompanying proposed rule (MCL) has not yet been promulgated.

The proposed MCLG is approximately two orders of magnitude higher than the existing Ambient Water Quality Criteria concentration, discussed in the previous subsection, because it is based on recent ingestion studies using laboratory animals (rats) rather than extrapolation of inhalation effects to ingestion. The results of this study showed no evidence of carcinogenicity for ingestion of the short-range fibers (<5 um) in either male or female rats and no evidence of carcinogenicity for ingestion of the intermediate range fibers in the female rats. However, there was an increase in benign polyps of the large intestine for the male rats ingesting the intermediate range fibers (.10 um) at a dosage of 1 percent of their diet.

COMMONWEALTH OF PENNSYLVANIA (STATE) ASBESTOS REGULATIONS

The Ambler Asbestos Piles are existing industrial waste piles. PADER currently regulates existing asbestos piles under the NESHAPS regulations. The NESHAPs regulations require a 6-inch vegetated cover for closure of asbestos disposal sites. NESHAP asbestos air emission standards state that no visible emission are permitted from an asbestos disposal site. The Locust Street and Plant Piles are not completely covered and therefore are not meeting NESHAPs regulations for closure. No visible emissions were observed however, from the uncovered areas during the RI field investigation.

Asbestos is a solid waste as defined under the Solid Waste Management Act, Act of July 7, 1980, Act No. 1980-97, 35 P.S. Section 691.1 et seq.. Disposal of asbestos and asbestos containing waste at an unpermitted facility in Pennsylvania is unlawful. Permitted facilities must comply with the Department's rules and regulations governing solid waste management facilities. The Commonwealth consistently requires that asbestos and asbestos containing waste be disposed at permitted solid waste management facilities subject to the above Act and the Department's rules and regulations governing solid waste management facilities. The State ARAR's applicable to closure of the Locust Street and codified in 25 P.S., Chapter 273. Applicable requirements related to slope design, cap design, vegetative cover, and surface water control are found in Chapter 273.

OTHER INFORMATION TO BE CONSIDERED

The information presented below, although not ARARs, were considered by EPA and the remedy selected is consistent with these guidelines.

To date, no ambient air standards for asbestos have been developed. Numerous ambient air studies have been conducted which have established background asbestos concentrations. These have been used to develop guidelines for identifying what concentrations may constitute "elevated" asbestos concentrations at various geographic locations. One prominent study was conducted by Dr. E.J. Chatfield for the Ontario Research Foundation in May 1983 which summarized the literature findings in this regard. Listed below are the recommended ambient air guidelines for several areas in the United States, Canada, and Europe based on the Chatfield study.

RECOMMENDED AMBIENT AIR GUIDELINES

State of Connecticut (proposed) - 30 day Average (electron microscopy)	30 ng/m3 or 30,000 total asbestos fibers/m3 (equates to 0.03 fibers/cc)
Province of Ontario - - 24 hour Average (electron microscopy) (>5 um)	40 fibers/liter (equates to 0.04 fibers/cc)
- 30 minute Average weight	5 ug/m3
Province of British Columbia (Optical)	<0.04 fiber/cc
West Germany (proposed) (electron microscopy) - (>5 um)	1 fiber/liter equates to 0.001 fibers/cc)
Montreal Urban Community (optical)	0.05 fiber/cc
New York City (recommended by Nicholson) (electron microscopy)	100 ng/m3
France (Conseil Superieur d'Hygiene Publique de France proposed ambient air quality inside buildings) (electron microscopy)	50 nf/m3

These guidelines and others developed by the scientific community are based on potential adverse health effects which have been indicated for asbestos exposures; and are discussed in greater detail in the Endangerment Assessment.

OCCUPATIONAL HEALTH AND SAFETY ACT (OSHA)
29 CFR Part 1910 AND 29 CFR Part 1926
(Latest revision April 30, 1984)

OSHA regulates asbestos exposure in the workplace. Occupational exposure to asbestos in all industries except construction is regulated by 29 CFR Part 1910. Construction industry exposure is regulated by 29 CFR Part 1926. The two rules are essentially the same. The rules address areas such as maximum exposure levels, workplace cleanliness, respirator use, and employee health monitoring. They set an 8 hour time weighted average Permissible Exposure Limit (PEL) of 0.2. fibers per cubic centimeter of air as determined by PCM. Only fibers longer than 5 um and a length-towidth ratio of 3:1 or greater are counted. If this concentration is exceeded, engineering controls must be implemented or work practices such as respiratory protection must be used.

45 FR 79318 -- AMBIENT WATER QUALITY CRITERIA (November 28, 1980)

The EPA has published recommendations on toxic pollutant water quality criteria as required by 1977 amendments to the Clean Water Act, as amended. The criteria are not binding standards but rather guidelines for the states to use to establish surface water quality standards. Guidance was provided for 64 toxic pollutants including asbestos. The guidance document states that for maximum protection of human health, the ambient water concentration should be zero based on the assumption that there is no threshold below which asbestos is not a carcinogen. Recognizing that zero concentrations are probably not obtainable, the EPA estimated that an increased lifetime cancer risk of 10^{-5}, 10^{-6}, and 10^{-7} could result from ingestion of surface water containing asbestos concentrations of 300,000, 30,000 and 3,000 fibers/liter, respectively. These values were based on extrapolating the potential risk associated with ingestion of asbestos in drinking water. These guidelines were not based on ingestion studies.

Endangerment Assessment

EPA is required to undertake an Endangerment Assessment (EA) to properly document and justify its assertion that "an imminent and substantial endangerment to the public health of welfare or the environment "resulting from" an actual or threatened release of a hazardous substance may exist (Section 106 of CERCLA, 42 U.S.C. Section 9606). This EA addresses the potential human health and environmental impacts associated with the Ambler site under the no-action alternative, that is, in the absence of remedial corrective action).

The results of sampling performed during the Remedial Investigation (RI) in soil, surface water, sediment, and air were reviewed to identify chemicals to be evaluated in this Endangerment Assessment. Chemicals were selected for detailed evaluation if they were present in environmental media at concentrations above background concentrations and/or could be related to past disposal practices at the site. The chemicals that were selected (see Table 3) consisted of asbestos, the primary chemical of concern at the Ambler site (detected in all sampled environmental media), twelve inorganic chemicals, most of which were detected in surface water, and two categories of polycyclic aromatic hydrocarbons (PAHs), noncarcinogenic PAHs and carcinogenic PAHs. Among the selected chemicals, adequate toxicity values for use in a quantitative risk assessment were not available for five of the selected inorganics (aluminum, calcium, iron, magnesium and potassium). These chemicals were not, therefore evaluated in this Endangerment Assessment. Available data, however, indicate that these chemicals are of relatively low toxicity via the oral route compared to the other chemicals evaluated and most are also essential human nutrients.

Human Health Risk Assessment

Pathways through which individuals may be exposed to chemicals at and from the Ambler site were reviewed and those pathways most likely to be of concern to human health were identified for further analysis. The most important potential human pathways of exposure for the Ambler site that were evaluated were:

- Inhalation of asbestos in ambient air;
- Inhalation of asbestos during certain activities which stir up asbestos;
- Incidental ingestion of chemicals in surface water;
- Incidental ingestion of chemicals in soil; and
- Incidental ingestion of chemicals in sediment.

Under present site and land use conditions, the potentially exposed populations include residents living in the Ambler site area, individuals who work in the site area, and individuals who regularly visit the area (such as those using the Wissahickon Watershed Association facility). In the future, assuming no further remediation actions are taken at the site, additional residences or commercial facilities could be built adjacent to the site. Given the inherent instability of the Locust Street and Plant Piles it would not be feasible to build structures on them. However, other nearby on-site industrial construction or activities could potentially affect the piles and increase exposed areas of asbestos and migration of asbestos from the site.

Risks from the pathways listed above were characterized by first comparing concentrations of chemicals in the sampled environmental media to Applicable or Relevant and Appropriate Requirements (ARARs) identified for the Ambler site. Because ARARs were not available for all of the selected chemicals in all of the sampled environmental media, a quantitative risk assessment was also conducted. In this evaluation, estimates of potential chemical intakes through each pathway identified for evaluation were combined with the chemical specific toxicity values to predict potential risks associated with the Ambler site. For each pathway, an exposure scenario was developed based on assumptions about the environmental behavior and transport of the potential chemicals of concern, and the extent, frequency, and duration of exposures.

TABLE 3

SUMMARY OF ENVIRONMENTAL MEDIA Analysis

Chemical	Environmental Media in Which Substances were Detected								
		Surface Water			Soil			Sediment	
	Air	Creek	Drainage-ways	Lagoons	Borings < 4 ft.	Borings >= 4 ft.	Test Pits	Creek and Drainage-ways	Lagoon
Asbestos	x	x	x	x	x	x	x		x
Inorganic:									
Aluminum			x	x					
Barium			x						
Calcium			x			x		x	x
Copper			x			x		x	x
Iron			x						
Lead			x						
Magnesium			x			x		x	x
Manganese			x			x			
Nickel						x			
Potassium			x	x					
Silver			x	x					
Zinc				x		x			x
Semi-Volatile Organics: Organics:									
Carcinogenic PAHs:									
Benzo(a)anthracene						x		x	
Benzo(b)fluoranthene						x			
Benzo(k)fluoranthene						x			
Benzo(a)pyrene						x			
Chrysene						x		x	
Indeno(1.2,3-cd) pyrene						x		x	
Dibenzo(a,h)anthracene						x		x	

AR001759

TABLE 3 (Continued)

SUMMARY OF ENVIRONMENTAL MEDIA Analysis

Chemical	Air	Surface Water: Creek	Surface Water: Drainage-ways	Surface Water: Lagoons	Soil: Borings < 4 ft.	Soil: Borings >= 4 ft.	Soil: Test Pits	Sediment: Creek and Drainage-ways	Sediment: Lagoon
Noncarcinogenic PAHs:									
Napthalene						x		x	
2-Methylnaphthalene						x			
Acenaphthene						x			
Fluorene						x			
Phenanthrene						x		x	x
Anthracene						x		x	
Fluoranthene						x		x	x
Pyrene						x		x	x
Benzo(g,h,i)Perylene						x		x	

These factors were used to predict potential exposures to the set of selected chemicals for both an average and a maximum plausible exposure case. For noncarcinogens, results are presented as the ratio of the Chronic Daily Intake (CDI) of each chemical to its Reference Dose (RfD), and as the hazard index, which is the sum of the CDI:RfD ratios for each chemical. If the hazard index exceeds one, health hazards might result from such exposures. In the case of carcinogens, the excess upper bound lifetime cancer risk was estimated; this risk is expressed as a probability. A risk of $1x10^{-6}$, for example, represents the probability that an individual will develop cancer as a result of exposure to a carcinogenic chemical over a 70-year lifetime. EPA has suggested developing remedial alternatives for cleanup of Superfund sites for total excess lifetime cancer risks from 10^{-7} to 10^{-4}.

For asbestos, based on the comparison to chemical-specific ARARs, it was concluded that under present site use conditions the "no visible emission" criteria for asbestos developed under the Clean Air Act is not currently being exceeded. In the future, however, increased erosion and weathering of the piles could increase the potential for visible asbestos emission. In addition, exceedance of these asbestos regulations would likely occur if the site were disturbed by vehicular activities. Such activities would most likely occur as part of a remedial action involving removal of the site were disturbed by vehicular activities. Such activities would asbestos contaminated soil from the site. In addition, concentrations of asbestos measured in surface water would exceed the Ambient Water Quality Criterion for the protection of human health.

It was concluded that potential releases of asbestos to ambient air from the Ambler site may occur due to the existence of exposed areas containing asbestos. It was further concluded that potential human health risks to nearby residents may be associated with releases of asbestos from such exposed areas at the site into ambient air.

Potential asbestos inhalation exposures during specific types of activities that can stir up asbestos fibers, such as children playing in soil on the piles, were also qualitatively evaluated. Under present site use conditions at the Ambler site, activities that could stir up asbestos fibers include playing and biking on the piles by children and outdoor tasks conducted by workers employed in the site area (e.g., employees at the Nicolet plant). It was concluded that these and other activities could continue to occur in the absence of site remediation (i.e., under the no-action alternative). Among sub-populations who may repeatedly engage in these types of activities, cumulative asbestos exposures of concern to human health could potentially result.

Quantitative risks were estimated for the remaining exposure pathways. The results are summarized by pathway in Table 4 for both noncarcinogenic and potentially carcinogenic chemicals.

Risks associated with incidental ingestion of surface water by children playing in Wissahickon Creek, drainageways and standing surface water were evaluated for selected chemicals (asbestos and seven inorganic chemicals). The excess lifetime cancer risks for asbestos were estimated for three separate areas, Wissahickon Creek, drainageways and standing surface water off-site behind the piles, and drainageways near the Maple Avenue piles (upstream of the Ambler site). The cancer risks ranged from $3x10^{9}$ for the average case to $7x10^{8}$ for the maximum plausible case. It should be noted that there are several sources of asbestos in Wissahickon Creek (e.g., other than the Ambler site) and thus risks associated with ingestion of asbestos from Wissahickon Creek cannot be attributed solely to the Ambler site. Among the other chemicals selected for evaluation in this risk assessment, only inorganics were detected in standing surface water and drainageways. All of these inorganic chemicals are noncarcinogens for which EPA has developed reference doses (RfDs). All of the chemicalspecific CDI:RfD ratios for the detected inorganics were well below one as was the hazard index (the sum of all the chemicalspecific ratios), indicating that noncarcinogenic effects would not occur from this exposure pathway.

Risks associated with incidental ingestion of chemicals present in on-site soil by children were evaluated for those chemicals detected in surface soil samples (asbestos from zero to four feet and PAHs from four to seven feet). For the noncarcinogenic PAHs, the ratio of the CDI to the RfD was well below one, indicating that adverse noncarcinogenic human health effects would not occur. The total excess lifetime cancer risks were estimated to range from $1x10^{-6}$ for the average case to $6x10^{-5}$ for the maximum plausible case; both risks were basically associated with ingestion of asbestos. It is important to recognize the complexity involved in estimating cancer risks for incidental ingestion of asbestos present in soil.

EPA has developed a unit risk factor for exposure to asbestos in surface water only, and not for exposure to asbestos from other environmental media where concentrations may be reported on a mass (not fiber) basis. In order to quantify risks associated with incidental ingestion of asbestos in soil, the EPA unit risk factor was converted into a mass-based potency factor. Based on this conversion, the excess lifetime cancer risks for incidental ingestion of asbestos from soil were estimated to be $1x10^{-6}$ for the average case and $6x10^{-5}$ for the maximum plausible case. Because of the uncertainty inherent in converting from a fiber-based unit risk factor to a mass-based potency factor, the uncertainty associated with risks related to exposure to asbestos through this pathway may exceed an order of magnitude uncertainty. Additional uncertainty is added by the fact that only benign tumors were noted in the bioassay which is the basis of the potency factor.

TABLE 4

SUMMARY OF POTENTIAL RISKS ASSOCIATED WITH EXPOSURE PATHWAYS QUANTITATIVELY EVALUATED FOR THE AMBLER ASBESTOS SITE

Exposure Pathway	Hazard Index[a]		Excess Upper Bound Lifetime Cancer Risk[b]	
	Average Case	Maximum Plausible Case	Average Case	Maximum Plausible Case
Ingestion of surface water[c]				
- Wissahickon Creek	NS	NS	$3x10^{-9}$	$1x10^{-8}$
- Drainageways and standing surface water	<1	<1	$5x10^{-9}$	$3x10^{-8}$
- Near Maple Avenue piles	NS	NS	$3x10^{-8}$	$7x10^{-8}$
Ingestion of on-site soil	NS	NS	$1x10^{-6}$	$6x10^{-5}$
Ingestion of sediment from drainageways and standing surface water	<1	<1	$4x10^{-8}$	$3x10^{-6}$

NS = Chemicals other than asbestos were not sampled for in these areas.

[a] The hazard index indicates whether or not exposures to mixtures of noncarcinogenic chemicals may result in adverse health effects. A hazard index less than one indicates that adverse human health effects are unlikely to occur.

[b] The excess upper bound lifetime cancer risk represents the additional probability that an individual may develop cancer over a 70-year lifetime as a result of the specific exposure conditions evaluated.

[c] The only carcinogenic chemical detected in surface water samples was asbestos and thus the listed risks are associated solely with asbestos ingestion from surface water.

Exposures and risks associated with incidental ingestion of sediment were evaluated for children who may play in the Wissahickon Creek area, drainage-ways, or standing surface water pools. The selected chemicals that were detected were copper and PAHs; these chemicals were detected in drainage-way sediments. Asbestos was not detected in drainageway or creek sediments. The CDI:RfD ratios for copper and noncarcinogenic PAHs and the hazard index were well below one indicating that adverse noncarcinogenic PAHs in sediments, the excess lifetime cancer risks were estimated to range from $4x10^{-8}$ for the average case scenario to 3×10^{-6} for the plausible maximum case scenario. The source of the PAHs cannot be attributed solely to the Ambler site.

Ecological Risk Assessment

The following pathways by which environmental receptors at and near the Ambler Asbestos Piles site could be potentially exposed to contaminants originating at the site were considered:

- Contact with and ingestion of water by aquatic life in Wissahickon Creek, and drainage ditches feeding into the creek and other surface water;

- Direct contact with and ingestion of soil by birds and mammals when preening, grooming, or foraging for food;

- Ingestion of prey by birds and mammals;

- Ingestion of surface water by birds and mammals; and

- Uptake of contaminants in the (PAHs) soil by plants.

Based on a qualitative assessment of the potential impacts of the above exposures, the following conclusions were reached, that there is an adverse impace to the local ecology. (This information is detailed in the RI/FS).

ARARs for the remaining selected chemicals consist of Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs) under the Safe Drinking Water Act and Ambient Water Quality Criteria (AWQC) for the protection of human health. Chemical concentrations measured in surface water at and near the site can be compared to these ARARs although none of the sampled surface water bodies are being used or are planned to be used as a drinking water source. Concentrations of the selected chemicals (twelve inorganic chemicals, most of which were detected in surface water, and two categories of polycyclic aromatic hydrocarbons (PAHs), non-carcinogenic PAHs and carcinogenic PAHs), and five inorganics (aluminum, calcium, magnesium, and potassium) in lagoon surface water did not exceed the available ARARs. Among the chemicals detected in standing surface water and drainageways (only asbestos was sampled for in Wissahickon Creek), the maximum concentrations of lead, manganese and nickel exceeded the proposed MCLG, the secondary MCL (not health-based) and the AWQC, respectively. The geometric mean concentration of manganese also exceeded the secondary MCL.

It should be noted that this comparison was very conservative in that none of these surface water bodies are being used or planned to be used as drinking water sources. These chemicals were not, therefore, evaluated in the EA. Available data, however, indicate that these chemicals are of relatively low toxicity via oral route compared to the other chemicals evaluated and most are also essential human nutrients.

ALTERNATIVE DEVELOPMENT

The overall objective of the CERCLA Feasibility Study (FS) process is the identification of the most appropriate, cost-effective[a] alternative(s) for remediation of a site the effectively mitigates and minimizes threats to and provides adequate protection of public health and the environment and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable (See Section 121(b), (d), of CERCLA, 42 U.S.C. Section 9621(b), (d) and 40 C.F.R. Section 300.68(i)). In accordance with Section 121(b) of CERCLA, emphasis in the FS for the Ambler Asbestos Piles site was placed on remedial technologies that reduce the toxicity, mobility, or volume of wastes and contaminated materials.

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[a] In the legislative history to the 1986 amendments to CERCLA Congress clarified its definition of cost-effective remedial action (Congressional Record, October 3, 1986, page H9102) as follows: "The term costeffective means that in determining the appropriate level of clean-up, EPA first determines the appropriate level of environmental and health protection, and then selects a cost-effective means of achieving that goal. Only after EPA determines, by selection of applicable or relevant and appropriate requirements (ARARs), that adequate protection of human health and the environment will be achieved, is it appropriate to consider cost-effectiveness."

The General Response Section that follows identifies the general response actions and associated remedial technologies applicable to this site. The initial screening of potential remedial technologies, based on RI information, is presented in a subsequent section. The technologies are screened to eliminate those that have limitations for specific chemical constituents and site characteristics, or have inherent technological limitations. This screening is performed in accordance with 40 C.F.R. Section 300.68 and Section 121 of CERCLA.

GENERAL RESPONSE ACTIONS

A number of general response actions have been identified for the Ambler Asbestos Piles site based on the information and data presented in the RI. These response actions, the associated remedial technologies, and the site problem areas to be addressed are presented in Table 5. The identified response actions and technologies include source control and management measures, as well as "no action." The no action response alternative is used as a base line against which other measures are evaluated.

The on-site sources of current and future public health risks have been identified as the asbestos-containing waste materials in the piles and surface water/sediment of the settling basins and filter bed lagoons. As a result, remedial technologies are considered that primarily address asbestos. The remediation of the spent magnesium/calcium carbonate, which constitutes a significant portion of both piles, is also considered in the screening process.

TABLE 5

GENERAL RESPONSE ACTIONS AND ASSOCIATED REMEDIAL TECHNOLOGIES FOR THE AMBLER ASBESTOS PILES SITE

General Response Action	Potential Remedial Technologies to be Screened	Site Problems Primarily Addressed
No action	Monitoring Upgrade Site Security	Does not address site problems except for reducing human and wildlife contact of exposed areas areas of the piles and surface water/sediment of settling basins and filter bed lagoon

General Response Action	Potential Remedial Technologies to be Screened	Site Problems Primarily Addressed
Surface Water Management, and Erosion Control/Sedimentation Measures	Surface Water Management - Regrading and revegatation - Diversion ditches and interception trenches - Sedimentation ponds and basins	Improves drainage patterns from piles (tops and side slopes to minimize further asbestos exposure). Divert runoff to minimize cover erosion on slopes and collects runoff to control sediment sediment transport off-site.

Capping	Capping Techniques
	- Synthetic membranes
	- Low permeability soils
	- Surface sealing
	  - Soil/bentonite admixtures
	  - Asphalt/concrete
	- RCRA-type multilayer
	- Stabilizing cover system
		Contains asbestos fibers in pile waste material and sediments in basins and lagoons preventing entrainment of fibers into ambient air and surface water.

Complete or Partial Removal	Excavation/Dredging of Solids, Pumping and Filtration Liquids	Removes source of asbestos in surface water sediments, and waste piles.
In Situ Treatment	Thermal Treatment - In situ vitrification	Stabilizes asbestos in order to prevent entrainment of asbestos fibers into ambient air.
On-Site	Thermal Treatment - Vitrification solidification/stabilization - Cement/poozolanic - Thermoplastic microencapsulation - Precipitation/flocculation/sedimentation - Filtration - Evaporation	Reduces mobility and/or toxicity of asbestos contaminants.

TABLE 5
(continued)
GENERAL RESPONSE ACTIONS AND ASSOCIATED REMEDIAL TECHNOLOGIES FOR THE AMBLER ASBESTOS PILES SITE

General Response Action	Potential Remedial Technologies to be Screened	Site Problems Primarily Addressed
Off-Site Treatment	Solidification/Stabilization - Cement/Pozzolanic - Thermoplastic micro-encapsulation Physical/Chemical Treatment - Precipitation/flocculation/sedimentation	Stabilize asbestos to prevent/reduce entrainment of asbestos into ambient air and transport area surface water. Removal of asbestos fibers in lagoon surface water prior to discharge to creek
Off-Site Disposal	Landfill	
On-Site Disposal	Landfill	Containment of asbestos in waste piles and lagoon sediments.

The objective of remediation of the asbestos-containing waste is to prevent migration into the ambient air and transport via stormwater runoff to Wissahickon Creek. A consideration of remediation of the magnesium/ calcium carbonate is to improve the physical characteristics (increase strength, lower moisture content) in order to improve the stability of the piles and/or allow for off-site transport of this material. The objective of remediating the surface water in the settling basins and filter bed lagoons is to allow for discharge to Wissahickon Creek, or potentially to the local Ambler Wastewater Treatment Plant.

SCREENING OF POTENTIAL REMEDIAL TECHNOLOGIES

The surface area volume of the waste piles, lagoon surface water, and sediments containing asbestos were estimated using pertinent surface and subsurface data.

A breakdown of the estimated volumes and surface areas are presented below.

Waste Piles	Volume (cu. yds.)
Plant Pile	615,000
Locust Street Pile	640,000
Settling Basins/Filter Bed Lagoons	
Sediments (assume 3 ft. thick)	4,500
Surface Water	1.9 x 106 gallons
Surface Area	40,500 sq. ft.

SCREENING PROCESS

The objective of this screening is to initially identify the remedial technologies best suited for further consideration in developing remedial alternatives for the Ambler Asbestos Piles site. The focus of the screening process is to eliminate technologies, based on information obtained from the RI, that are not feasible because they may prove difficult to implement or have severe limitations that would prevent achievement of the remedial objectives. The technologies are considered according to their technical feasibility in relation to site and waste characteristics and applicability to the problem areas of the site and cost.

Potential remedial technologies will be screened using the following process. First, a brief description of the technology is presented with a discussion of its potential application to site problem areas. Then, a discussion of the technical reliability (technology development, performance, and safety) and implementability in relation to site, waste, and technology characteristics is represented. The technologies are also screened for their suitability to the site according to environmental, public health, and institutional considerations. A recommendation is then made to retain or eliminate the technology for further consideration based on the criteria described.

SUMMARY OF TECHNOLOGIES

The screening of the remedial technologies is summarized in Table 6. The technologies that have been retained after the screening process for use in developing remedial action alternatives are listed as follows:

- No action with security upgrade and monitoring;
- Surface water management and erosion and sediment controls;
- Stabilizing cover system and stabilization of existing cover soils;
- Complete or partial removal;

- On-site solidification/stabilization;
- On-site precipitation/flocculation and sedimentation;
- On-site filtration;
- On-site vitrification;
- Off-site disposal.

DEVELOPMENT OF REMEDIAL ACTION ALTERNATIVES

Remedial action alternatives have been formulated hereafter to address the environmental issues and contaminant pathways related to the Ambler Asbestos Piles site. These alternatives have been developed based on the following considerations:

- The remedial alternatives were formulated using the technologies retained from the screening process discussed previously. The technologies considered to be applicable to the remediation of the identified environmental issues of the Ambler Asbestos Piles site are summarized in Table 6.

- Techniques that are complementary and/or interrelated were combined into alternatives. For example, in one alternative -- On-Site Closure, installation of an improved cap on the waste piles is combined with backfill of the lagoon, on-site sedimentation and erosion controls, protection against scouring along the creek, and surface water treatment (of lagoon water).

- The alternatives were also developed to address the remedial action objectives established for the site. Not all of the alternatives developed will equally satisfy the objectives or be as effective in addressing part or all of the site issues and contaminant pathways.

- The purpose of the alternative development process is to cover a range of effective remedial action alternatives. (See 40 C.F.R. Section 300.68). Therefore, the alternatives were differentiated according to the degree of remediation they provide. Various remediation categories under source control action specify a range of remediation levels. These categories are as follows:

  No action: No action alternatives may include minimal actions such as installation of fences/gates and monitoring activities.

  A number of treatment alternatives ranging from one that would eliminate, or minimize to the extent feasible, the need for long-term management

Table 6 (continued)

General Response Action And Associated Remedial Technologies	Retained for Alternative Development	Technical Considerations	Other Considerations	Recommended Application to Site Problem in Remedial Alternative
b. Physical/chemical: Precipitation/ flocculation and sedimentation	Yes	Proven technology and commonly used treatment process. Has been demonstrated effective for removal of asbestos from water. Laboratory bench-scale or pilot-scale testing required to determine effectiveness and optimum process parameters.	Eliminates risk to public health and environment (Wissahickon Creek) due to off-site migration of asbestos contaminated water. May require polishing step to conform with discharge permit/regulations. By product sludge requires disposal/treatment. Relatively low cost; equipment readily available.	Lagoon surface water
c. Physical: Filtration	Yes	Proven technology and commonly used treatment process. Has been demonstrated effective for removal of asbestos from water. Use as first treatment step may result in rapid clogging of micropore filters. Laboratory bench-scale or pilot-scale testing required to determine effectiveness and optimum process parameters.	Eliminates risk to public health and environment (Wissahickon Creek) due to off-site migration of asbestos contaminated water. May require polishing step to conform with discharge permit/regulations. By product sludge requires disposal/treatment, Relatively low cost; equipment readily available. Backwash or spent filters require disposal/treatment may be effective as polishing step for other treatments.	Lagoon surface water
d. Physical: Evaporation	No	Proven technology for treatment of various municipal and hazardous wastes. Most effective for treatment of wastes with high solids content; lagoon waters may not exhibit desirable characteristics for effective treatment. Data not available to show process demonstrated effective for treatment of wastes similar to those at site. Laboratory bench and pilot scale tests would be required.	Potential risk due to public health from entrainment of fibers in process vapor stream. Waste stream would require further treatment. Permitting not required under SARA, regulatory agency approval required.	Not Recommended

44

AR001771

Table 6 (continued)

General Response Action And Associated Remedial Technologies	Retained for Alternative Development	Technical Considerations	Other Considerations	Recommended Application to Site Problem in Remedial Alternative
5. In Situ Treatment				
a. Thermal: In situ vitrification	No	Developing technology that has been successfully tested on large-scale (400 to 800 tons) radioactive waste materials. Vitrified mass expected to have long-term stability. Pilot studies required before implementation. Problems may be encountered due to heterogeneity of waste materials. Installation of electrodes may be difficult or impractical due to steep slopes and low strength of piles. Power requirements may be excessive due to high moisture content of materials. Potential exists for collapse of piles during treatment.	Could effectively immobilize inorganic contaminants. Costs could be restrictive due to high power requirements.	Not Recommended
6. On-Site Treatment				
a. Thermal: Vitrification	Yes	Developing technology demonstrated on limited basis on pilot-scale for treatment of asbestos insulation materials from abatement actions. Pilot testing would be required prior to implementation at the site. Problems could be encountered due to heterogeneity of the waste materials (such as high moisture content, presence of high concentrations of calcium/magnesium carbonate).	Vitrified mass would require disposal. Risks to public health and environment could be eliminated; asbestos immobilized. Potential exists to recycle glassified product. Potential risks associated with removal activities from release of asbestos to air. Regulatory and local agencies approvals required. Major potential ambient air problem during remedial action.	Waste piles lagoon sediments

Table 6 (continued)

General Response Action And Associated Remedial Technologies	Retained for Alternative Development	Technical Considerations	Other Considerations	Recommended Application to Site Problem in Remedial Alternative
b. Physical/chemical: Precipitation/ flocculation and sedimentation	Yes	Proven technology and commonly used treatment process. Has been demonstrated effective for removal of asbestos from water. Laboratory bench-scale or pilot-scale testing required to determine effectiveness and optimum process parameters.	Eliminates risk to public health and environment (Wissahickon Creek) due to off-site migration of asbestos contaminated water. May require polishing step to conform with discharge permit/regulations. By product sludge requires disposal/treatment. Relatively low cost; equipment readily available.	Lagoon surface water
c. Physical: Filtration	Yes	Proven technology and commonly used treatment process. Has been demonstrated effective for removal of asbestos from water. Use as first treatment step may result in rapid clogging of micropore filters. Laboratory bench-scale or pilot-scale testing required to determine effectiveness and optimum process parameters.	Eliminates risk to public health and environment (Wissahickon Creek) due to off-site migration of asbestos contaminated water. May require polishing step to conform with discharge permit/regulations. By product sludge requires disposal/treatment, Relatively low cost; equipment readily available. Backwash or spent filters require disposal/treatment may be effective as polishing step for other treatments.	Lagoon surface water
d. Physical: Evaporation	No	Proven technology for treatment of various municipal and hazardous wastes. Most effective for treatment of wastes with high solids content; lagoon waters may not exhibit desireable characteristics for effective treatment. Data not available to show process demonstrated effective for treatment of wastes similar to those at site. Laboratory bench and pilot scale tests would be required.	Potential risk due to public health from entrainment of fibers in process vapor stream. Waste stream would require further treatment. Permitting not required under SARA; regulatory agency approval required.	Not Recommended

Table 6 (continued)

General Response Action And Associated Remedial Technologies	Retained for Alternative Development	Technical Considerations	Other Considerations	Recommended Application to Site Problem in Remedial Alternative
e. Solidification/stabilization	Yes	Solidification techniques not effective in long term stabilization of asbestos wastes. Weathering of solidified asbestos work can result in future releases. Solidification of calcium carbonate wastes with fly ash would allow for the removal of this waste for partial on-site or off-site disposal.	Stabilization of calcium carbonate waste will allow for removal of this waste and redisposal in a more stabilized pile on-site or off-site	Waste piles
7. Off-Site Treatment technologies discussed under on-site/off-site disposal				
8. Off-Site Disposal	Yes	This technology involves excavation of contaminated materials and transport to approved off-site disposal sites. Commercial RCRA and municipal landfill capacity is limited and high volumes may not be accepted. Potential disposal in municipal landfill with special permitting.	Materials are not treated or destroyed but the threat to the local environment is eliminated by removing the contaminated materials to a secure site. Potential risks to public health associated with removal and transport of the asbestos due to airborne asbestos fibers a RCRA-approved or municipal (with proper permitted) landfill must be used. Applicable U.S. DOT requirements for shipment of waste must be met. Magnesium/calcium carbonate material may need to be stabilized. Potential major ambient air quality risk during remedial action.	Waste piles lagoon sediments
9. On-Site Disposal	No	This technology involves excavation of contaminated materials followed by disposal in an on-site newly constructed landfill meeting applicable RCRA standards. Incorporates proven techniques and would include surface management and infiltration control. Site characteristics may warrant construction of an aboveground landfill. Implementation is limited because of severe space limitations at the site and high volumes of material.	Favorable impact to public health and environment due to securement of contaminated materials. Regulatory agency approval required. There may be problems due to dust/airborne asbestos from excavation activities. May not meet with public or local agency approval.	Not Recommended

(including monitoring) at a site, to one that would use treatment as a primary component of an alternative to address the principal threats at the site.

Alternatives that involve containment of waste with little or no treatment, but provide protection of human health and the environment by preventing potential exposure and/or by reducing the mobility.

- The alternatives were developed to a level adequate to apply the non-cost and cost evaluation criteria, discussed in further detail later in this section.

The cost-effective alternative is defined as the lowest cost alternative that is technologically feasible and reliable, effectively mitigates or minimizes damage, and provides adequate protection of public, welfare, and the environment (See Section 40 C.F.R. Section 300.68(i) and Section 121(b)(1) of CERCLA). Section 121 of CERCLA, 42 U.S.C. Section 9621, adds that the most cost-effective alternative is one that achieves results that cannot be achieved by less costly methods.

As per CERCLA Section 121 the development of a complete range of treatment alternatives may not be practical in some situations. Alternatives within this range typically will differ in the extent of treatment used and the management requirements of treatment residual or untreated wastes. For example, for sites such as the Ambler Asbestos Piles site with large volumes of potentially low concentrated wastes, such an alternative screened for their suitability to the site according to environthat eliminates the need for long-term management may not be reasonable given site conditions, the limitations of technologies, and extreme costs that may be involved.

With respect to the Ambler Asbestos Piles site, the remedial action technologies that remain after screening are generally under the source control classification, since on-site controls are the most appropriate to this site.

Remedial action alternatives that have been developed for the Ambler Asbestos Piles site are presented in summarized form in Table 7. For a given alternative, each of the areas of concern are addressed and the associated Alternative types from40 C.F.R. Section 300.68 (f) is identified.

EVALUATION CRITERIA

This subsection describes the criteria used for the evaluation of the developed remedial alternatives. The four remedial action alternatives formulated in Table 7 are evaluated further based on both non-cost and cost criteria.

Table 7

Remedial Action Alternatives for the
Ambler Asbestos Site

Remedial Action Alternative	Description of Alternative		Problem Areas Addressed
1. No Action	• Site security improvements and monitoring.	• No action.	• Site security improved.
2. Excavation/Removal – Off-Site Disposal	• Excavation of waste piles and lagoon sediments. • Pump water from lagoon. Treatment of water. • Disposal at off-site facility.	• Disposal at off-site facility.	• Volume reduction to zero (on-site).
3. On-Site Vitrification/ Stabilization	• Construction/operation of on-site processing plant(s). • Pump water from lagoon. Treatment of water. • Excavation of waste piles and lagoon sediments. • Vitrification of asbestos materials (piles and sediments). • Solidification of calcium/ magnesium carbonate materials. • On-site and/or off-site disposal of vitrified/solidified materials.	• Treatment.	• Toxicity and mobility of asbestos contaminants reduced.

Table 7
(continued)

Remedial Action Alternative	Description of Alternative		Problem Areas Addressed
4. On-Site Closure	• Pump water from lagoon. Treatment of water. • Installation of geotextile over lagoon sediments and backfill of the lagoon. • Installation of geotextile and soil cover over exposed asbestos on piles. • Installation of scouring protection along the creek adjacent to the Locust Street Pile. • Upgrade of site security. • Erosion/sedimentation control (for runon and runoff).	• Containment with little or no treatment.	• Mobility of asbestos contaminants reduced.

The objectives and criteria described herein are consistent with Section 121 of CERCLA, 42 U.S.C. Section 9621 40 C.F.R. Section 300.68. The procedures in the NCP are specific for hazardous substance response and are consistent with the requirements of the National Environmental Policy Act (NEPA).

Section 121 of CERCLA, 42 U.S.C. of CERCLA Section 9621 requires that preference be given to remedies that permanently and significantly reduce the mobility, toxicity, or volume of the hazardous substances themselves. In addition, preference is to be given to remedies using alternative treatment technologies. Off-site transport and disposal of hazardous substances without treatment is designated the least favored alternative.

NON-COST CRITERIA

Non-cost criteria are described in detail in the subsections that follow and include:

- Technical Feasibility

- Institutional requirements

- Public health and environmental issues

1. Technical Feasibility - The technical feasibility criteria address critical objectives in the technical evaluation of potential remedial action alternatives. These objectives include performance, reliability, implementation, and safety.

2. Institutional Requirements - These institutional factors are used to evaluate the acceptability of each technology to local, state, and Federal agencies, as well as the potential for compliance with existing or future regulatory policies. As an example of institutional criteria, all on-site actions generally require approved sedimentation and erosion control plans (if major earthwork is to be performed).

3. Public Health and Environmental Issues - The remedial action selected must adequately protect human health and the environment. The remedial alternatives are evaluated for their effectiveness in mitigating the existing or potential contaminant exposure to the public. Documentation that the action adequately controls both the longterm effects to the residual contamination and short-term effects caused by implementation of the remedial action, and protects the public, both during and after the remedial action, is required. Applicable health and environmental health standards are used to evaluate each alternative. The overall goal of the selected remedial action is to mitigate the existing environmental threats without creating additional adverse effects.

COST CRITERIA

According to Section 121 of CERCLA, 42 U.S.C. Section 9621, a remedial cleanup program must be implemented and operated in a cost-effective manner and must mitigate the environmental concerns at the site. Section 121 of CERCLA requires ensuring that the results of a particular alternative cannot be achieved by less costly methods. It implies that there may be more than one cost-effective remedy, with each remedy varying in its environmental, human health, and institutional results. In considering the cost-effectiveness of the various technologies, costs are considered as follows:

- Capital costs
- Operating and maintenance costs
- post-remediation (monitoring) costs.

Monitoring and maintenance operations can represent a substantial portion of a remedial action strategy. Remedial strategies should aim to minimize the added costs for these operations.

The present worth value method (1988 dollars basis) is utilized to evaluate the total cost of a remedial action strategy, including the post-closure period. The cost-effectiveness for the various technologies is compared based on total present worth.

EVALUATION OF ALTERNATIVE 1: NO ACTION WITH SECURITY IMPROVEMENTS AND MONITORING

A. DESCRIPTION

The purpose of evaluating this no action alternative is to provide a basis for comparison of existing site conditions with the other proposed remedial action alternatives. This alternative consists of performing no physical remediation work to the piles or lagoon site area. Security improvements consisting of new fencing, access/egress gates (with locks), and the provision of appropriate warning/informational sign are included in this alternative. These improvements would be designed to meet the current EPA, NESHAPS, and PADER regulations regarding closed solid waste (asbestos-containing) landfills. Figure 10 graphically depicts a logical location of these fencing, gates, and sign improvements.

In addition, visual inspections (biannual for the first five years after implementation) and environmental ambient air monitoring would be performed during the following five years after implementation in order to evaluate whether this action alone adequately protects human health and the environment.

No other improvements or remedial measures would be undertaken under this alternative (see Fig. 10.)

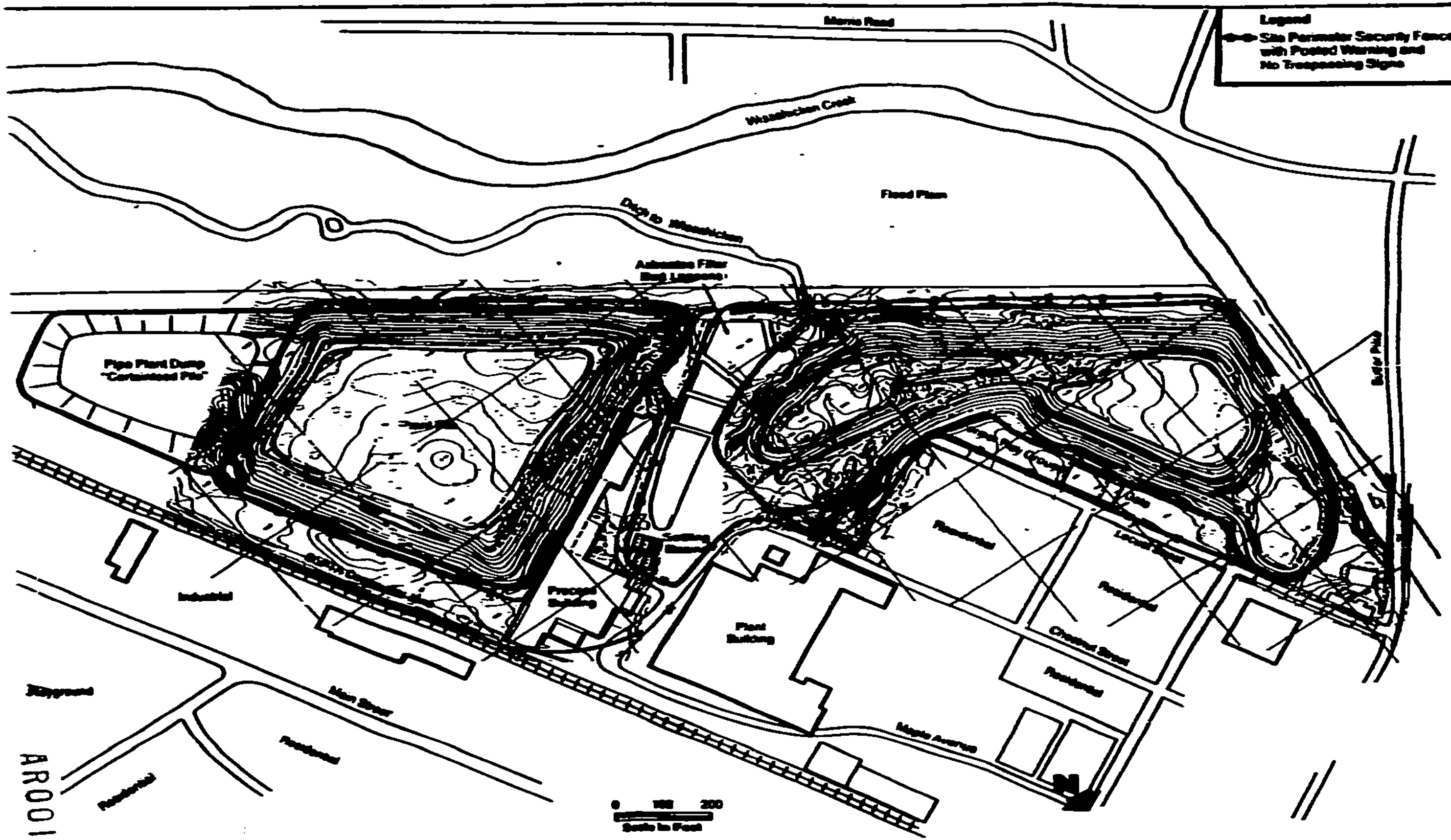

FIGURE 10 NO ACTION ALTERNATIVE

AR001780

B. NON-COST EVALUATION

1. Technical Considerations

Since no remedial actions other than site security improvements, continued inspection, and environmental monitoring are taken under this alternative, a detailed technical evaluation is not directly applicable. In general, however, no affirmative action to prevent direct contact/incidental ingestion or ambient air inhalation exposures to on-site receptors would occur. As mentioned in the technology screening subsection of this document, it is most likely that even with a new fence, gate, posted signs, and warning system, trespassers (mostly children) would continue to access the site. The exposed, noncovered plateaus of both piles and incomplete and eroded areas of the pile side slopes would continue to be a major source of asbestos and potential off-site migration of asbestos and potential off-site migration of asbestos if disturbed.

In addition, no action to reduce the toxicity, volume, or mobility of the contaminants would occur as stipulated within Section 121 of CERCLA, 42 U.S.C. Section 9621.

No affirmative action toward meeting the chemical specific ARARs nor the action specific State ARARs identified in Altenative 4 would occur. In time, surface water quality from eroded/uncovered pile areas and the lagoon discharge would continue to worsen with no provisions for future maintenance/ repairs. Also, the potential of future releases of asbestos into the ambient air if the exposed areas of the pile are disturbed or cover failure/ erosion continues would not be addressed.

2. Institutional Considerations

The following institutional/administrative considerations are associated with this no action alternative:

- Ability to obtain approvals from other agencies is doubtful based on no affirmative action over the long-term.

- Unfavorable community response (by residents of Ambler Borough, adjacent communities, and local environmental groups such as the Wissahickon Watershed Association) would be expected due to the projected degradation of ambient air and surface water quality.

- Compliance with site-specific ARARs is not addressed over the short- or long-term.

3. Human Health and Environmental Considerations

This no action alternative, as previously described, includes site security and warning sign improvements. These measures would serve to make access to the piles and lagoon areas more difficult to unauthorized personnel, and thereby reduce to some degree the present and future risks via direct contact/ incidental ingestion and inhalation of ambient air exposures to on-site receptors. It could be realistically expected, however, that based on historical accounts, some trespassers would access the site area and locations of exposed asbestos.

The site is currently partially fenced-in and warning signs are posted in some areas, although these structures are not continuous or prominent, and are generally in bad repair. Also, the gates are not continually locked.

Compliance with chemical-specific ARARs would also not be provided relative to on- and off-site surface water quality and ambient air asbestos fiber concentrations.

In addition, although visual and environmental monitoring would be provided for, the results of these activities appear to be a "faitaccompli" in that without maintenance and repair, the existing soil cap will most likely continue to fail at localized side slope areas of the piles; thereby exposing more asbestos to the environment. In this regard, no reduction in future risks to on- or offsite receptors is provided for, and in actuality, the situation/risks would worsen (particularly for off-site receptors). No increase in long-term reliability is provided for via this alternative.

It is further expected that although no current unacceptable risks to off-site receptors resulting exclusively from this site can be quantified (due to other existing potential asbestos sources in the area), the situation would worsen with time until either these other sources are remediated. Releases from this site would increase to the degree where numerical degradation of air and surface water quality would be quantifiable, and directly related to this site.

In summary, the non-cost-related considerations and feasibility for long-term effectiveness of this alternative are not favorable.

C. COST EVALUATION

Capital costs associated with this alternative include fencing to enclose the site, installation of gates and locks, and warning signs on the fences. The total capital cost for Alternative 1, presented in Appendix A, Table 8 is estimated at $165,000.

Operating and Maintenance (O&M) costs are estimated at $23,400/yr, as shown in Appendix A, Table 9. These costs are incurred during long-term monitoring for asbestos and maintenance of the facility. A summary of the total costs and the present worth analysis of each alternative are presented in Appendix A.

EVALUATION OF ALTERNATIVE 2: EXCAVATION/REMOVAL - OFF-SITE DISPOSAL

A. DESCRIPTION

This alternative consists of complete excavation and removal of the Locust Street Pile, Plant Pile, and Lagoon areas waste materials to an off-site permitted/approved landfill.

The general major components of this alternative are shown in Figure 11 and would include:

Piles

- Diversion of runon and construction of runoff containment/ treatment facilities;
- Complete excavation of the waste materials (asbestos wetting and/or dewatering as applicable, as well as calcium/magnesium carbonate dewatering) - Level C protective measures would be required for remedial activity for approximately 50 percent of the time;
- Continuous air and surface water monitoring;
- Bagging of asbestos wastes, physical conditioning/ solidification of interior wastes prior to loading and transport to an approved facility;
- Transport equipment decontamination prior to site egress;
- Soils testing for verification of cleanup criteria;
- Hauling clean soil fill and fill/regrade the site for positive drainage;
- Revegetate.

Lagoon

- Diversion of runon and collection of runoff;
- Pump down and treatment surface water contents in lagoon (estimated at 1.9 million gallons);

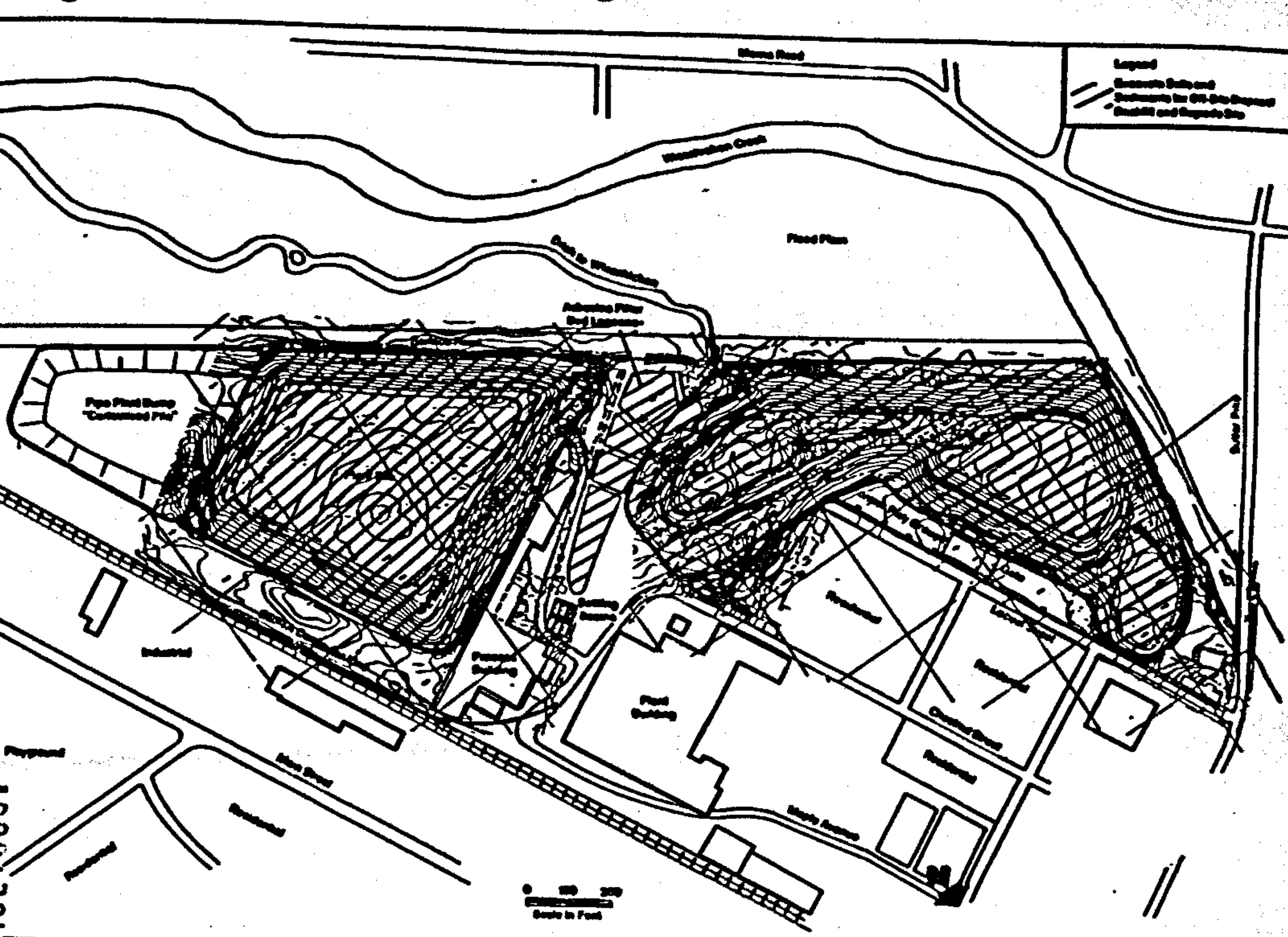

FIGURE 11 ALTERNATIVE 2 - OFF-SITE DISPOSAL

AR001784

- Complete excavation/removal of lagoon materials (sands, sediments, ballast berms, discharge structure, etc.), including dewatering as applicable;

- Repair and restrict access to stone culvert adjacent to lagoon and restrict future access;

- Bagging and loading of waste materials prior to loading and transport;

- Air and surface water monitoring.

- Decon of transport equipment prior to egress from the site;

- Test soils to verify cleanup criteria are met;

- Fill in lagoon area with clean borrow soils and regrade for positive drainage;

- Revegetate.

EP Toxicity tests performed on the underlying calcium/magnesium carbonate waste materials and cinder/slag material did not result in leachates that exhibited hazardous waste characteristics in terms of EP toxicity. Within this assumption, these waste materials, as well as the other miscellaneous debris that make up the piles and lagoon wastes, could be landfilled in a solid/municipal waste landfill.

The results of the geotechnical boring and test pit sampling programs performed during the RI indicate that the quantities (in cubic yards) waste materials contained in each of the three source areas on-site are as follows:

	Waste total
Locust Street Pile	615,000
Plant Pile	640,000
Lagoon	4,500
Total	= 1.26 ± million cubic yards

A detailed remedial design would need to be prepared in order to perform this alternative safely due to the saturated and unstable physical condition of the interior of both piles. In addition, prior to and during construction, extensive health and safety protocols would need to be developed and implemented to minimize migration of asbestos-contaminated wastes into the air and surface water after intruding into the piles and/or lagoon. Also, it would have to be determined where these wastes would and/or could be taken for off-site landfilling due to the massive quantity involved. These considerations are discussed/evaluated later in this subsection.

B. NON-COST EVALUATION

1. Technical Considerations

This alternative would involve very extensive remedial design and preconstruction planning work. It appears this alternative could be feasible from a strictly technical viewpoint; however, it would be a massive construction undertaking (particularly from geotechnical and construction safety points of view) and would span over many years. The major advantage to this alternative is that the waste materials would be completely removed, thereby reducing to the greatest degree possible the permanent remedy with reference to this site (although the wastes would be deposited elsewhere with the same volume and toxicity characteristics). If solidification/stabilization of the calcium/ magnesium carbonate material was performed prior to hauling off-site, the final volume may actually be greater.

Another advantage is that future monitoring/maintenance of the site to ensure long-term integrity would not be required.

The constructability of this alternative is somewhat questionable at this time. Additional geotechnical testing and stability analysis would need to be performed to evaluate the stability of the piles, as portions of the piles were removed for off-site disposal. Of greatest concern is the stability of the calcium carbonate waste contained by the cinder, slag, and solid asbestos waste berms. In many portions of the piles, where the calcium carbonate is nearly or totally saturated, the bearing strength of this material is too low to support its own weight and acts as a viscous fluid. This means that the asbestos-contaminated cinder and slag berms material could not be removed in one phase or the interior of the piles would slump, creep, or even collapse suddenly upon removal of its existing lateral support.

Obviously this condition would be very dangerous to construction workers and others who may enter the site. Also, these waste materials would tend to slump down and consume more ground space, which is generally not available, particularly adjacent to the creek, existing structures, and possibly even the commuter rail line. This condition would get even worse during precipitation events.

Accordingly, construction would need to proceed in phases from the middle-top of each pile and down toward the existing ground surface. It is believed that even under this mode of operation, the heavy equipment required could not be supported by the pile materials. Localized puncture shear failures would occur without first stabilizing the material, as was performed during the field investigation to access the drill rig. The piles may not be able to support large construction equipment, resulting in potential deep circular or other type failure of the side slopes. The slope stability analysis of the piles indicates the piles could support light- to medium size equipment. Physical safety would be a major concern. Runoff quality would be very poor, requiring treatment prior to discharge from a chemical, pH, and total suspended solids loading point of view. Due to the heterogeneous nature and age of the piles, it also would not be known what other types and/or sizes of foreign objects may be encountered inside the piles. Extensive dewatering and treatment of the decant liquids would also be required. Solidification via admixture of dry materials would likely be necessary in order to make this material both transportable and landfillable. Without providing some degree of solidification, transport off-site may be a very "sloppy" operation. Spills and leakage would be expected enroute to the designated new landfill(s).

Removal of the asbestos process waste and the asbestos contaminated slag and cinder berm materials presents several problems that would also exist during remedial action. The two most prevalent of these would likely be releases of asbestos fibers to the ambient air and surface water during excavation and loading and transport, along with the need to "double-bag" these materials per current regulations for transport and disposal of asbestos. A mechanical system would likely need to be designed and constructed to accomplish this without extensive handwork that could result in direct contact and potential inhalation of asbestos fibers by workers. Even with this type of system, maintenance would be required, foreign objects would likely upset the mechanical operation, and cleanup of spillage would be required.

It could be argued that by wetting down the exposed asbestos wastes, acute releases could be controlled. However, it was noted during the RI drilling program that the surface of exposed materials can dry out during prolonged hot and windy conditions. Realistically, it is believed that migration of asbestos fibers into the air could occur during weekends, holidays, shut-down periods, and potential periods of worker inefficiency during the wetting operation. Extensive monitoring would be required on an almost continual basis.

Full-time supervision and inspection by OSHA and/or other agencies would likely be required. Extensive transport vehicles, decontamination, and site security policies would be needed to ensure that asbestos is not racked/spilled offsite in Ambler Borough, adjoining communities, and enroute to the receiving landfill(s).

As a rough estimate, at a rate of 40 truckloads per day (one truck-load leaving the site each 15 minutes for a duration of 10 hours per day); a five-day work week; and 20 cubic yards per truck; it would take approximately 6 years of continuous operation to remove 1.26 million cubic yards.

The contaminated lagoon sediments consist mainly of sand and soil, with varying quantities of asbestos fibers present. These sediments are located beneath an estimated one-half to ten feet of water currently in the lagoon. The sediments and other contaminated media would be removed to a depth where sampling and testing indicated that the cleanup criteria for asbestos-contaminated material had been met. For this reason, the quantity of material to be removed is very difficult to estimate. Assuming a three-foot layer of contaminated sediment on the bottom, and when adding the volume of contaminated adjacent surface soils and the ballast/slag beams that were apparently installed to filter the effluent prior to discharge, the projected approximate quantity of asbestos-contaminated media is 9, 600 cubic yards.

Excavating the sediment from the lagoon would require that it be drained or pumped out first, followed by the use of a clam shell crane or dredger. Excavation would begin at approximately 10 feet below grade and extend to an undetermined depth. Such an operation would proceed very slowly and would present risks to on-site workers.

In summary, the technical feasibility of the alternative is not favorable for the various reasons discussed above.

Institutional Considerations

The availability of landfill space in the somewhat local area is also a realistic concern with this alternative. Municipal/solid waste landfill capacity in the areas surrounding this site (Pennsylvania, New Jersey, Delaware, Maryland areas) is not abundant. Also, many of the landfills that do have capacity are not currently permitted to accept asbestos wastes. Problems also exist with transporting and landfilling wastes to out of state locations, which further realistically limits available sites for disposal.

According to conversations with PADER, the landfills that are currently permitted to receive asbestos-contaminated wastes (classified as "special handling municipal waste") in the eastern Pennsylvania area include:

- Grand Central Landfill - Located in Plainfield Township, North Hampton County, Pennsylvania. The projected capacity is 840,000 cubic yards (provided by operator), which is planned to be filled with other solid waste over the next two years. The distance from Ambler is approximately 50 miles.

- Pottstown Landfill - Located in Pottstown, Montgomery County, Pennsylvania. The remaining existing capacity is 2,000,000 cubic yards (plus or minus). The existing time frame expected to fill this space with other solid waste is approximately 2 years. It is located approximately 40 miles from Ambler.

- Empire Sanitary Landfill - Located in Taylor Borough, Lackawana County, Pennsylvania. It is located approximately 100 miles from Ambler. Available remaining capacity was not available.

In addition to potential lack of available landfill capacity, it would take a multidisciplinary remedial action contractor (and likely an array of subcontractors) with substantial technical, financial, and manpower resources to undertake a project of this nature. These type of firms do exist, but are not abundant.

Other institutional considerations involved with this alternative include:

- Potential delays, coordination problems, and/or disapproval by other involved agencies (state, county, and local) due to various factors.

- A likelihood of objections by the local citizens in Ambler communities, communities enroute to the receiving landfill, and particularly the receiving community due to risks involved with releases of asbestos to ambient air and environmental media the result of major intrusions into the piles, transport problems, and potential releases at the receiving facility.

Compliance with ambient air, surface water, and occupational requirements may also be difficult to achieve during remedial action under this alternative.

In summary, although some citizens and officials in Ambler Borough would likely favor the long-term advantage of removing the piles from the borough and "reclaiming" this land, the overall institutional feasibility of this alternative is not favorable. (See Section 121(b)(2) of CERCLA, 42 U.S.C. Section 9621(b)(2)).

3. Public Health and Environmental Considerations

A long-term, post-remedial reduction in future risks to on-and off-site receptors on and around this site could be accomplished through implementation of this alternative. Long term compliance with sitespecific ARARs and elimination of future inspection and maintenance could also be accomplished through this alternative.

As discussed in the previous subsections, however, the excavation of these materials could likely cause increased releases of asbestos fibers into the ambient air and surface waters. The health risks to workers, the adjacent community, and environment posed by these releases have the potential to be substantial and could be prevented with another alternative that did not entail excavation or major disturbance of these materials.

This alternative would entail significant potential health and safety risks to workers, including direct contact with great quantities of asbestos-laden materials and physical safety hazards associated with the potentially unstable piles if major intrusive activities were performed.

Over the "short term" (during remedial action), increases to existing risks are assured should this alternative be selected. Also, as previously discussed, the length of time involved to remediate the site under this alternative is substantial.

In summary, the feasibility of this alternative with respect to human health and environmental considerations has some advantages over the long-term. However, the substantial potential for increased risks to on-site and offsite receptors during remedial action appears to outweigh the long-term advantages.

C. COST EVALUATION:

The capital cost for alternative 2 is estimated at $2,446,000, as presented in Appendix A, Table 10. Operating and maintenance (O&M) costs are provided in Appendix A, Table 11. The O&M costs have been estimated at $30,828,000 for the first seven years during remedial activities and $2,800 for five years after remediation. Post-remediation costs involve monitoring activities to verify effective cleanup.

EVALUATION OF ALTERNATIVE 3: ON-SITE VITRIFICATION/STABILIZATION (VIA PROCESSING PLANT(S))

A. DESCRIPTION:

This alternative would involve further pilot-scale development and analysis, and potential future construction of a full-scale vitrification and/or vitrification and stabilization plant(s) on the site.

Vitrification is a process wherein asbestos-contaminated materials can be transformed by melting (at extremely high temperatures (1,300.F)) into a nontoxic glass-like material.

This process differs from the technology referred to typically as "in situ vitrification", which melts the contaminated material through probes driven into the contaminated material. Consequently, this process requires excavation of the asbestos contaminated materials, hauling to the plant, and fed into the furnace structure. Electric power construction requirements for the vitrification process, based on reported data (supplied by vendors), would be very large (estimated at 1,000 kw per 1 ton of asbestos waste processed). A new electric substation would likely need to be constructed on or near the site, or substantial revisions to the existing facilities and major service lines than run into the site.

Vitrification in both of these forms has been, and continues to be, an application of interest to regulatory agencies, including EPA; and is most accurately described in its current state of development as an "innovative technology." EPA has/is currently evaluating these processes as part of its Superfund Innovative Technologies (SITE) program. At least one "demonstration project" regarding vitrification via the processing plant type of operation has been performed in the recent past. EPA and REM II personnel visited a pilot plant version of this process at a former glass works in Martinsburg, West Virginia, on June 29, 1987, to investigate this technology's potential applicability for use at the Ambler Asbestos Piles site. A "trial burn" using bagged asbestos material from abatement projects was run through this plant; which was developed, constructed, and operated by "Vitrifix of North America, Inc." Relatively small quantities (with relation to the volume of asbestos-contaminated materials that would require processing at the subject site of this RI/FS) appeared to have been successfully transformed into glass-type end products during this demonstration.

At the time of the pilot plant visit, only 1 ton/hour of asbestos material was being processed with plans to increase feed rates to 5-6 tons/ hour. These materials generally contained a higher average asbestos content (45 percent asbestos) than expected from the pile wastes and lagoon sediments that would require processing at this site. The "feedstock" was noted to consist mostly of previous bagged asbestos abatement types of wastes (from building and factory cleanups); although some lower content asbestoscontaminated materials were also processed. The process also requires the addition of soda lime-based glass (or other source of sodium ions for use as an electrolyte) to maintain the electric current across the electrodes that melt the asbestos wastes. Normally 20 percent of the feedstock is glass (cullet).

From the work performed and results published to date, the processing plant type of vitrification appears to be a viable and potentially promising technology for asbestos transformation and detoxification at certain types of sites and waste streams. To our knowledge, however, no fullscale, extended runs have been performed to date that limit current ability to totally evaluate the technical, operational, and cost related variables of this technology over the long-term.

At this time, several vendors are apparently working on variations of this technology for potential large-scale application to sites of various types. Vitrifix of North America, Inc. previously submitted a method statement (November 1986) for applicability of their process to the Nicolet Plant Pile Wastes which was evaluated by EPA.

With regard to the Ambler Asbestos Piles site, this technology appears most applicable to the asbestos-contaminated materials from both piles and the lagoon sediments.

It is technically possible that this type of process can include the calcium/magnesium carbonate wastes as part of the cullet feedstock if sand is also added. Although the quantity of calcium carbonate in the piles far exceeds the volume that could be processed based on an 80 percent asbestos/20 percent cullet feedstock ratio.

Regarding these internal materials, it is also possible and potentially more practical to stabilize the magnesium/calcium carbonate wastes via pozzolanic, cement-kiln dust (CKD) and/or thermoplastic solidification/stabilization methods (although no bench- or pilot-scale studies have been performed to our knowledge on these materials in this regard). These technologies have been utilized on various other types of projects, however; with same degree of success.

In simplified form, the major components and sequence of construction for Alternative 3 are shown in Figure 12 and are as follows:

- Research, test, analyze, and further develop the potential vitrification and/or stabilization technologies on a bench-scale, to a greater degree with site-specific materials leading toward possible approval of certain pilot- and full-scale systems to "treat" on-site the waste materials at this site (treatability studies).

- Construct full-scale on-site facility(ies). Many significant feasibility variables such as location and space requirements; electric and other utility services; financial and liability agreements; environmental emissions and discharge limitations; health and safety protocols; etc., would need to be worked out prior to start of construction.

- Excavate, haul, and stockpile waste materials from both piles and the lagoon in a sequenced manner (over a number of years) in order to provide the feed materials to the plant(s). Site preparation (runon diversion, runoff control, haul roads, etc.) similar to those previously described under Alternative 2 -

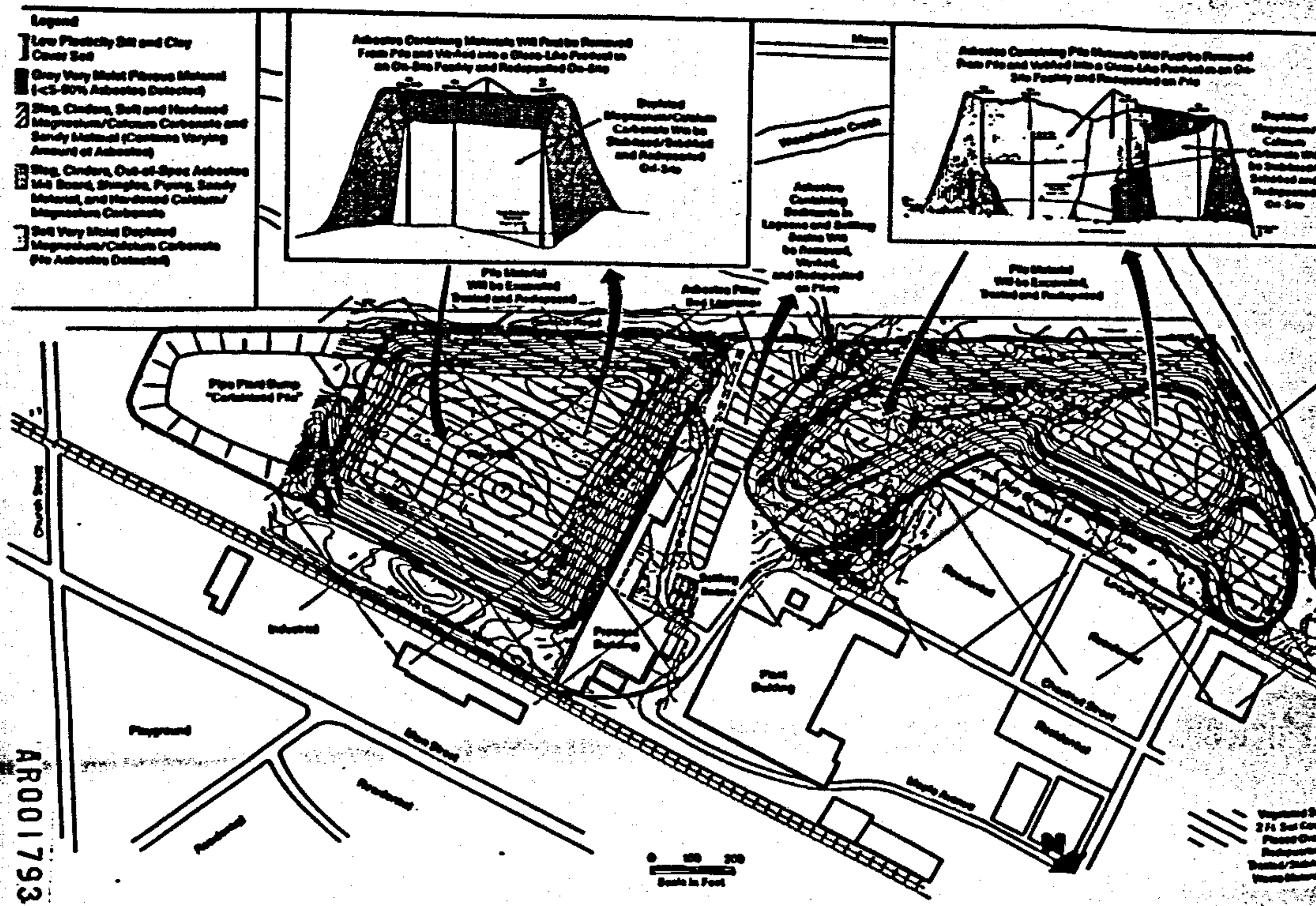

FIGURE 12 ALTERNATIVE 3 - ON-SITE

Excavation and Removal, would need to be employed first. Substantial constructability and health and safety concerns (releases of contaminants to ambient air) would need to be addressed first, as previously discussed.

- A "set-aside area" would have to be constructed to deal with large and/or foreign materials that could not be fed into the plant. These materials would likely ultimately require landfilling either on- or off-site.

- Extensive environmental and personnel monitoring for workers and off-site receptors would be required in order to quantify potential releases and the impacts on the local ambient air. Even with required wetting and other dust/fiber suppression controls, unacceptable releases may occur as a result of excavation and process activities requiring a completely enclosed, "bubble canopy" work area. Even with these types of systems, exhausts and emissions are imminent and problems with current applications in other industries are well-documented.

- At best, the process would most likely require substantial modifications and/or additions as the project continued in order to deal with new data and the waste materials types/consistencies encountered during excavation.

- Assuming that the estimated 1.26 million cubic yards could be processed and/or segregated (and portions landfilled), it is not currently known what could/would be done with the final product. According to vendors, although there are certain potential useful purposes for the final product materials (i.e., roadbase materials, structural fill, landfill intermediate cover, etc.), to our knowledge no current reuses of these materials on a large-scale have been documented; not to mention post-reuse monitoring/evaluation of final product properties. With the current information available, it appears very likely that the great majority of these end-product materials would have to be relandfilled, either back on-site in the form of "new-piles" or transported off-site to an approved location for filling.

- At the completion of processing operations the plants(s) would need to be dismantled and removed unless a continued use for them could be found.

- The site would be backfilled and regraded for positive drainage, and revegetated. If materials are redeposited on-site, the material would be covered with a soil cover of a two-foot thickness. The cover would be vegetated and graded for positive drainage. It is not known at this time what volume reductions of waste materials could be expected using the vitrification process. Stabilization of the magnesium/calcium carbonate would result in an increase in waste volume. Space constraints and slope requirements may limit on-site redisposal.

In general, this alternative would involve extensive predesign/ implementation pilot studies and construction of facility safety and support systems. Because this treatment technology is not a proven technique for large volumes of wastes containing variable concentrations of asbestos, it can be estimated that it would take several years before the feasibility of this technique is proven. Assuming that the technologies could be developed and would prove feasible and effective, it would provide a potential for a permanent remedial solution for this site. However, the potential short-term health risks associated with the excavation and processing of asbestos material presents a considerable risk to local residences. Further discussion of technical, institutional, public health, and cost considerations are provided in the following sections.

B. NON-COST ANALYSIS

1. Technical Considerations

From a purely theoretical point of view, the vitrification/ stabilization process represents a technology that could offer many advantages toward permanent remediation of this site. The vitrification process has recently been recognized by EPA as a means of transforming asbestos into a less toxic form through "destruction" of asbestos fiber structure on a microscopic basis. In this way, the process is capable of reducing the toxicity and in certain ways the mobility of asbestos contaminants over a long-range basis. In relation to this site, however, several major and realistics technical limitations are involved; some have been described in greater detail earlier in this document as follows:

- The process itself has not truly been proven on a full-scale basis for application on a site such as Ambler. Asbestos Design requirements, construction technologies, operational problems, and site-specific considerations are at this time left undefined by the Vitrifix Company.

- The constructability of the excavation of the piles is a major concern and could prove to be not infeasible under under further study due to the problems and potential physical and chemical (asbestos) dangers that exist, as related to removing the asbestos-contaminated outer materials and having to deal with the saturated and almost negligible shear strength of the underlying interior calcium/magnesium carbonate wastes (which compromise the majority of the interior of the piles, as previously discussed).

- During the period of remediation, it is likely that many ARARs regarding ambient air and/or surface water quality would not be met.

- It does not appear that the vitrification process is intended for or best-suited to "treat" the interior pile materials. In this case, an additional stabilization process (pozzolanic or thermoplastic techniques, each of which are also currently untested with respect to this site), would likely be determined to be required. The methods, although possessing great advantages in their own regard, are generally classified as more encapsulative than destructive technologies; offering potentially less long-term reduction in toxicity and mobility. Also, under these techniques the volume of the final waste product to be dealt with in actuality increases through the addition of solid and reactive ingredients, certain of which possess their own leachable constituents that can affect other environmental media. If a ratio of one-half to one mixing (additive rate) is assumed as being required in order to bulk-up and increase the shear strength of the internal pile materials; and further, if this mixing ratio was proven to be required (in order to allow construction of more stable slope configurations, etc.) an increase of approximately 33 percent would occur in the final volume of resultant stabilized waste materials.

- This technology may result in contructing new piles of even higher elevation than those that exist, and it is not likely that this site could contain this increased volume, necessitating transport and landfilling off-site (unless an alternate reuse could be found).

- Regarding reuse potential for both potentially vitrified and/or stabilized wastes from this site, it is not known of any that currently and feasibly exist on such a large-scale basis. To our knowledge, no major local DOT agencies or others have endorsed largescale reuse of these products under their construction programs. Although these potential reuse options have merit for certain sites and specific waste streams, it is not believed that they are realistically feasible for this site at this time. At best, this alternative would involve years of pilot-scale testing before becoming potentially suitable and proven for use in such a large-scale project.

In summary, the technical feasibility of this alternative does not appear to be favorable.

2. Institutional Considerations

Regarding institutional and associated considerations, the following analysis is provided:

- Because no reuse mechanism for either the vitrified and/or stabilized materials is currently known of or envisioned in the near future for such a large-scale application, it is most likely that off-site landfilling at an approved landfill would at least partially be required (even if some percentage of the materials were relandfilled on-site to a more stable configuration after processing). As previously discussed, a potential shortage of currently projected landfill capacity for the regions around this site has already been evidenced, and is a recognized substantial problem; even without consideration of the relocation of extremely large volumes of waste material present at this site. Processing likely requires near "around-the clock" operation due to the major hardware investments and components to be developed near the plant to feed it. This would create even more potential source areas for migration of waste constituents (particularly asbestos to the air). Public reaction to this situation can be projected to be unfavorable due to exposure risks to off-site receptors.

- As previously discussed, transport safety concerns and the high potential for community disapproval of hauling wastes off-site would most likely exist.

- CERCLA (October 1987) states that certain sites may not be realistically suitable for application of treatment technologies. A portion of this subsection is included below for direct reference, as follows:

  "The use of treatment technologies may not be practicable at some sites with large volumes of potentially low concentrated wastes (e.g., large municipal landfills or mining sites). Remedies involving treatment at such sites may be extremely expensive or difficult to implement."

- Over the long-term (after remedial action), assuming that this alternative could become technically and institutionally feasible (which appears remote at this time), the sources of asbestos on-site would be greatly, if not almost entirely removed, except for residuals left on-site. In theory, this occurrence would seem to be advantageous. However, when considering the potential for substantial emissions/discharges to off-site areas during a longterm and extensive remediation project such as would result from this alternative, it is believed that the asbestos that could potentially migrate off-site in this time frame would continue to impact the surrounding area (via residual contamination to ambient air and surface water) for a period beyond the remedial action itself. It is possible that the amount of asbestos that could leave the site via these pathways may be more than what would leave the site over the long-term, even if no remediation at all beyond the current status was attempted.

In summary, the public health and environmental feasibility of this alternative is not favorable.

C. **COST ANALYSIS:**

The preliminary capital cost of Alternative 3: On-Site Solidification/Vitrification, is estimated at $99,376,000, as presented in Appendix A, Table 12. O&M costs are provided in Table 13. It is assumed that, using the vitrification treatment process, it will take 20 years to complete remediation of the site. Some costs estimated for this alternative are speculative due to the technical uncertainties that are associated with some of the components of the alternative. Post-remediation monitoring would be required; however, these costs have not been included in this estimate cause of the uncertainties associated with the length of time for completion to the vitrification treatment process and the relative low magnitude of monitoring costs compared to the remediation costs of this alternative.

EVALUATION OF ALTERNATIVE 4: ON-SITE CLOSURE

A. **DESCRIPTION:**

Alternative 4 involves placement of a cover system on each of the asbestos-containing waste piles and clean fill in the existing lagoon and settling basins. The major components of this alternative involve the following:

- Pumping of water from the lagoon and settling basins, followed by filtration for removal of asbestos fibers. Discharge of the treated water on-site. Placement of filter backwash on the waste piles;

- Installation of a geotextile over the lagoon and settling basins with clean, low permeability compacted soil (bringing the depression up to grade to promote long-term positive drainage);

- Backfill of the lagoon and settling basins with clean low permeability compacted soil (bringing the depression up to grade to promote long-term positive drainage);

- Installation of geotextile and soil cover for the top of the Locust Street and Plant Piles;

- Repair of erosion on waste pile side slopes due to storm events, soil creep, freeze/thaw effects, etc;

- Installation of gabions or Rip-Rap for protection of the Locust Street Pile from the scouring action of the Wissahickon Creek;

- Installation of fencing/locking gates to prevent unauthorized access to the site and, posting of warning signs;

- Erosion/sedimentation controls during remedial activities and until vegetation establishes;

- Air monitoring for asbestos during remedial activities (personnel and environmental);

- Post-closure inspections, maintenance of the piles, lagoon, and settling basin areas, and preparation of a contingency plan.

Figure 13 provides a graphic illustration of Alternative 4.

Implementing this alternative would first involve pumping the water from the lagoon and settling basins and leaving the sediments in place. A geotextile cover over the sediments (immediately after draining to prevent drying and wind dispersion) would be installed, followed by backfill with clean compacted soil. The backfill and geotextile cover would protect the buried asbestos fibers from freeze/thaw weathering and impede their potential resurfacing.

Since previous laboratory analyses showed that the lagoon and settling basin waters contain asbestos fibers, they must be treated before being discharged onsite. This treatment would include flocculation, followed by a mixed media filter in series with a microfilter to separate the suspended sediment and asbestos fibers from the water. The treated water could then be discharged on-site. The status of the current site NPDES permit would need to be checked and reapproved by the Commonwealth of Pennsylvania prior to discharge. Collected sediment and asbestos would be placed on the piles prior to cap construction.

It has been documented that asbestos fibers do not exhibit migration potential through underlying soils into the groundwater (U.S. EPA, Dalton, D., 1985). Therefore, infiltration and leachate control are not a primary concern at this site.

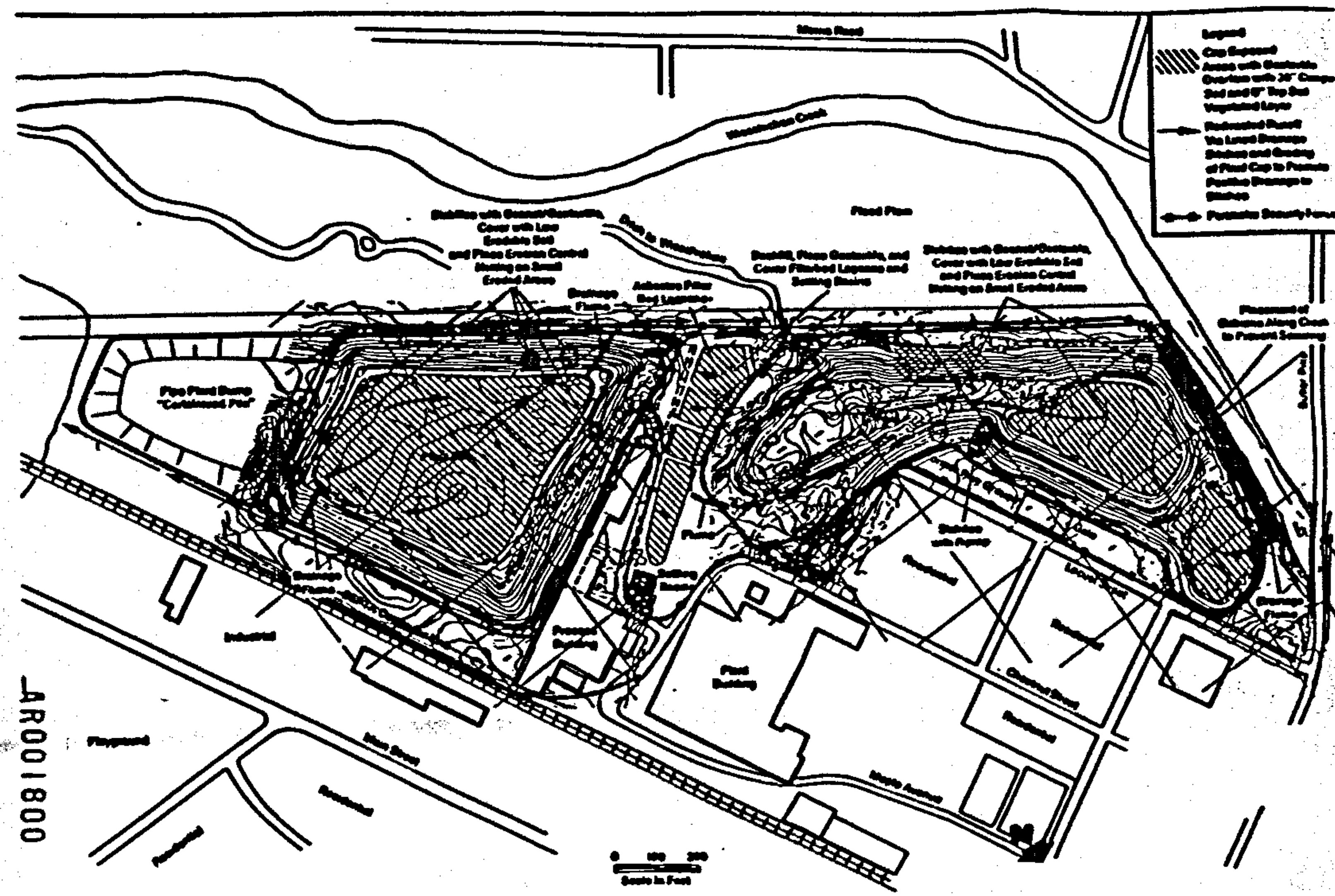

FIGURE 13 ALTERNATIVE 4 - ON-SITE CLO

AR001800

Cap construction would primarily involve covering the tops of the piles with a to be determined depth of recompacted soil (graded promote to drainage). The cap would consist of a geotextile fabric above which would be placed soil that exhibits low erosion characteristics. Trees, shrubs, and grasses would be cut down to pile level and covered with an impregnated geotextile material to inhibit future growth prior to placement of the geotextile and soil cap. Jute-netting would then be securely staked in place, where required, to hold the soil until vegetation establishes. The side slopes are already substantially covered, and a good stand of crown vetch vegetation exists in most locations. Additional soil would be placed over geotextile fabric that was cut to fit and anchored in place, then vegetated; where significant erosion has occurred to date. Drainage improvements via channels and flumes would also be performed.

Security at the site would be increased such that new eight-foot tall fencing with barbed-wire would be installed around the entire perimeter of the piles and lagoon area to prevent unauthorized access to on-site areas. Locking gates would be provided for access to authorized persons in the future. Warning signs would also be posted on the fences, detailing the asbestos hazards on-site.

Inspections of the site would be biannually for the first five years after initiation of remediation. A written report that details the effectiveness of remediation would be submitted at the end of five years (as required by Section 121 (c) of CERCLA, 42 U.S.C. Section 9621(c)). An annual inspection of the site would be required thereafter to ensure that human health and the environment are being adequately protected. Long term cap maintenance such as local erosion repair, grading, seeding, etc., will be required to promote cap integrity over the long term. However, based on action in 1984, future maintenance is expected to be low.

During on-site activities, erosion and sedimentation controls such as channels, silt fences, jute-netting, and sedimentation ponds would be used, as needed. Finally a contingency plan would be developed to ensure that appropriate remedial action will be taken if local failure of the new cap were to occur.

B. **NON-COST ANALYSIS**

1. Technical Considerations

The primary function of a cap that covers asbestos material is to provide a barrier between the asbestos and the atmosphere, thereby preventing releases of fibers into the ambient air. The cap must be structurally sound to prevent re-exposure of the asbestos fibers and provide the integrity necessary to ensure public health and safety at the site under existing and potential future uses. Cap design must include considerations for potential frost heave and/or settlement damage, as well as erosion control so that risks of exposure to asbestos fibers is minimized. The cap for the Ambler Asbestos Piles site should provide protection for the cap materials and underlying wastes against freeze/thaw effects and should provide increased stability to the surface of the piles.

Installation of a cap on the Locust Street Pile is complicated by the fact that a large number of mature trees and shrubs have grown in certain areas. Over a long period of time which could cause them to break off or fall over and uproot; with subsequent potential release of asbestos fibers. Also, in the summer, leaf coverage can prevent adequate growth of vegetation under trees. This increases the effects of erosion. These trees, shrubs, and grasses would need to be cut down to pile level and the trunks/roots left in place so that the asbestos would remain undisturbed. In this way, the potential for future release by uprooting is addressed. Also, vegetation would be able to grow around the trunks and serve to minimize erosion effects. A geotextile cover impregnated, rootgrowth discouraging geotextile would be placed over these locations to prevent resurfacing of major deep-rooted vegetation. These products are now commercially available for cap applications.

The useful life and reliability of a cap is significantly affected by the degree of maintenance it receives. Therefore, to maximize its efficiency and the length of time the cap maintains its integrity, maintenance would be required (particularly for the next 5 to 10 years after completion of remedial on-site closure).

Installation of a cap on each of the identified waste piles involves common construction practices and materials. However, at the Ambler Asbestos Piles site, the use of lightweight equipment is required because the piles may not be able to support heavy duty machinery in certain locations. The geotechnical analysis performed as part of the RI/FS has indicated a low factor of safety for most existing external side slopes on both piles (0.96 to 1.15 in general for critical locations). Additional detailed geotechnical analysis is recommended for the remedial design stage of the remedial action program for this site to investigate in greater detail how the additional surcharge weight of the three-foot soil cap proposed herein along with the weight of construction equipment during remediation may affect factors of safety for slope stability during and after remediation at specific locations around the piles. Substantial geotechnical effort has been expended during the RI/FS project in order to provide profiles of the piles, soil/waste strength data, existing condition slope stability analysis, etc. From a qualitative point of view it is not currently believed that the additional soil loading which would result from cap installation or surcharges from small, light construction equipment would realistically change the equilibrium of total driving to resisting forces which has apparently established itself in the many years that the main structure of the piles has existed and not failed (based on the proportion of the pile sizes to future additional soil loadings, and the decades over which the pile slopes have maintained themselves without apparent slope instability and no reported slope instability problems encountered during the 1984 emergency action); however, this needs to be confirmed by a more detailed and specific geotechnical analysis during remediation. The final determination in this regard is beyond the scope of this investigation.

For purposes of this ROD it is assumed that cap placement is feasible, with proper future analysis, safeguards, and controls in place.

Caps similar to that discussed in the description of this alternative have been proposed at other sites for asbestos remediation. In June 1987, the EPA issued a Record of Decision (ROD) for the Johns-Manville Superfund site in Illinois. Waste materials primarily containing asbestos fibers had been deposited in a variety of pits. According to the ROD, these pits were to be closed with a soil cap consisting of 6 inches sand, 18 inches clay, and 6 inches topsoil to be graded and vegetated.

The EPA has also taken a similar approach at a number of Superfund sites in Nashua, New Hampshire, and surrounding vicinity. Thirty-inch covers were installed at the Shady Lane, Pointer, Bursey, Matarazzo, Ridge Avenue, Lowell Road, Niquette Drive, Russell Avenue, and South Bank asbestos sites. The covers were applied in accordance with the U. S. Army Corps of Engineers specifications which include an application of geotextile fabric if slopes were encountered, then bank-run gravel, then pea gravel (if the bank-run gravel was too coarse), then topsoil. Erosion control devices such as concrete runoff pans, drainage ditches lined with bank-run or larger stone and vegetation acclimated to the area also were installed. If slopes were steep, gabion walls were erected to prevent sloughing of cover materials applied. The state of New Hampshire cover specifications differed in the depth of the cover; a 24-inch cover was deemed acceptable to the State. The 30-inch cover applied by the Corps of Engineers on the past actions might be increased to a 36-inch cover, so it is evident that there is some difference of opinion regarding the proper depth of the cover. As a point of reference, the Corps of Engineers unofficially designated a 50-year life expectancy on the 30-inch cover when the cover is applied over surface-exposed asbestos. The National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements include a six-inch cover with vegetation as provision of adequate protection to public health and the environment.

This thickness will be designed to ensure that the frost layer does not enter the waste materials more than 10 times per century.

By providing soil for this site, the amount of times that the frost layer reaches the waste materials is minimized. Therefore, the effects of freeze/thaw weathering are addressed. The geotextile fabric also serves to reduce freeze/thaw weathering effects by adding to the stability of the piles and cap system.

The sides of the Locust St. Piles has a soil cover that averages 12 to 18 inches thick. This material was placed as part of the 1984 Emergency Action at this site. This cover thickness meets NESHAP requirements; however, it is not as thick as the cap proposed for the top of the piles. This is because it is anticipated that the flatter top of the piles would be more susceptible to moisture and frost penetration. Additional soil is not proposed to be placed on the side slopes to attain a desired thickness as part of the alternative because a wellestablished vegetative cover already has been noted to exist on the great majority of the slopes on both piles currently, and no adverse affects from freeze-thaw effects have been apparent in the nearly four years since these soils have been in place.

Remedial action repair of the exposed side slope areas under this alternative would include placement of cut-to-fit and staked-in-place sections of geotextile fabric soil fill of comparable thickness to the existing cover on the side slopes (crown-vetch, since it has already proved successful to date at this site).

In general, the crests would be graded with fill prior to cap placement as to achieve a center-line crown and drain to the edges of the tops of slopes where drainage channels and corrugated metal flumes, combined with rip-rap would carry flows of the toes of the slopes and offsite through/or adjacent to the existing lagoon area. In this way, concentrated flows would be managed more effectively than by allowing the runoff to flow over the side slopes in a random manner (which would increase long-term erosion potential). A result of this action would be that the center of the pile tops would actually have more the depth of the soil cap. For the lagoon and settling basin remediation, sediments would have to be scraped or excavated from the sidewalls and deposited toward the center of the depression. This action is performed so that asbestos-containing materials do not remain near ground surface. The geotextile fabric placed over the sediments would prohibit upward migration of asbestos fibers and dispersion into the air before backfilling. The additional clean compacted soil backfill would also prohibit migration. This soil may be as thick as 10 to 15 feet in order to bring the lagoon area back up to original grade as to promote positive drainage.

As previously noted, the water from the lagoon and settling basins must be treated prior to discharge on-site. This treatment would consist of flocculation with the addition of lime, sedimentation, and passage through a sand filter. If needed, the water could also be sent through a microfilter.

Dust control and worker occupational safety measures (against potential asbestos and physical hazards) are required during remedial activities as part of this alternative, however, to a lesser degree than with alternatives involving substantial intrusion into the piles.

Overall, this alternative appears to be the most technically feas option to prevent future release of asbestos from the site, as well as minimizing potential for direct contact and inhalation exposures to asbestos during remediation.

2. Institutional Considerations

Several institutional considerations are associated with the onsite closure alternative. In some cases, permits may not be required for on-site remedial technologies (Section 121(e) of CERCLA, 42 U.S.C. Section 9621(e) and 40 C.F.R. Section 300.68(a)(3)). However, all of the processes associated with cap installation and water treatment must comply with the following action-specific ARARs and consider guidelines, as detailed below:

ARAR - An erosion and Sedimentation Control Permit from the PADER Bureau of Water Quality Management and/or the USDA Soil Conservation Service is not required for sites under 25 acres in size. However, the Montgomery County Conservation District requires that a soil erosion control plan be written and implemented for construction activities. This plan must be available for review on-site.

ARAR - A Floodplain/Stream Encroachment Permit is required by the PADER Bureau of Dams and Waterways for construction or alteration of permanent fill/structures along or in the channel or floodway of any stream. This regulation is directly applicable to the installation of gabions or rip-rap along the Locust Street Pile.

ARAR - A Discharge Permit from the PADER Division of Water Quality Management must be applied for and the expected pollutant levels identified if the potential exists for asbestos to be present in any discharge to surface water.

GUIDE-LINE - The OSHA standard of 0.2 fibers/cc for asbestos would be used as a guideline for determining appropriate safety practices. It is anticipated that during intrusive activities into the asbestos-containing material, Level C protection equipment will, as defined by U.S. EPA Interim Standard Operating Safety Guidance (January, 1983), be used.

GUIDE-LINE - Air sampling during construction activities that include disturbance of the fibrous material would be required under OSHA to monitor occupational exposure.

GUIDE-LINE - 40 C.F.R. Section 264, Subpart N - A multi-layered cap generally conforms to the RCRA technology guidelines, which recommend a three-layered system consisting of an upper vegetative layer, underlain by a drainage layer over a low permeability layer. The cap functions by diverting infiltrating liquids from the vegetative layer through the drainage layer and away from the underlying waste materials. The primary function of a RCRA cap is to control infiltration and leachate from the waste material that may contaminate underlying groundwater. A multi-layered cap is typically used for hazardous waste site closures, which this site is not (based on the RI data collected).

Accordingly, the design of the cap, need not be in accordance with RCRA regulations to be protective. The purpose of a multi-layered cap on an asbestos site is to prevent re-emergence of the waste on the surface of the site through the processes of wind and water erosion, freeze/thaw cycles, site use, etc. In addition, it is desirable to maintain some moisture content in the fibrous material to control airborne releases of asbestos in the event of localized re-exposure. Therefore, it is protective to use innovative cap designs at this site consisting of semipermeable materials.

ARAR - Pennsylvania Municipal Waste Regulations state that the final slopes of a landfill cover may not exceed a grade of 33 percent (25 PA 275.234). The side slopes of the Ambler Asbestos Piles exceed this 33 percent grade requirement in most locations. Alternative 4 does not provide for modification of the slopes, therefore, this ARAR will not be attained. Section 121(d)(4) of CERCLA, 42 U.S.C. Section 9621(4)(1), identifies several circumstances under which certain ARARs may be waived. Two of the permissable circumstances are listed below with an explanation of how they may apply to the Ambler Asbestod Piles site and Alternative 4 of this ROD.

- Compliance with this ARAR will result in a greater risk to human health and the environment than alternative options (See Section 121(d)(4)(B). In order to achieve a side slope that does not exceed a 33 percent grade for the waste piles, extensive regrading would be required if the toes of the piles were to remain in their present position. This would mean cutting into the asbestos waste and exposing the asbestos calcium/ magnesium carbonate contaminants below. Such action would pose a serious risk to human health and the environment because asbestos fibers would likely become airborn from the disruption. The calcium/manganese carbonate compounds would also have to be stabilized so that they could support a cover system.

- Compliance with this ARAR is technically impracticable from an engineering perspective See Section 121(d)(4)(C). Constructability would be a major concern. Some of the side slopes could be flattened to close to 33 percent by holding the top of slope constant and placing soil on all sides of both slopes. This could not be done around the piles' sides, however, without encroaching on existing structures, the Wissahickon Creek, a portion of Locust Street, the Sewer Authority collection system, and potentially, the railway tracks.

3. Public Health and Environmental Issues

It appears that Alternative 4 can address the remedial objectives, site environmental issues, and contaminant migration pathways identified in this ROD. Capping the Piles, backfilling the lagoon, and backfilling the settling basins can minimize, to the greatest the threat to the environment and public health from the contained asbestos fibers as long as the final caps are maintained. The following public health and environmental issues are associated with the On-Site Closure Alternative:

- Under this alternative, the asbestos-contaminated material at the Ambler Asbestos Piles site would be covered with geotextile and soil (waste piles, lagoon, and settling basins). This action can be expected to result in significant long-term reduction of potential public health risks and environmental impacts resulting from direct contact and migration of asbestos fibers via sediment, surface water, and air transport mechanisms, while minimizing major risks to construction workers that are likely with other alternatives.

- Proper grading, installation, and post-closure inspection can allow the cover to remain as an adequate barrier between fibrous material and the ground surface.

- A low possibility exists for short-term public health risks due to the limited disturbance of the asbestos materials that would occur during cap placement or during backfilling the lagoon and settling basins. However, limited airborne release of asbestos fibers to some degree may result from such actions. The risk to public health would be minimized by implementing an air monitoring program during on-site activities and by using erosion and dust control measures.

- Long-term maintenance and periodic inspections of the site to provide cap integrity and effective site security would need be established. A contingency plan would also need to be developed in the event that catastrophic cap failure occurs, thereby posing a threat to public health and the environment (indicated via the geotechnical analysis as an unlikely event as long as no major changes in external loadings are or internal pile conditions occur).

- Future land use in the lagoon and waste pile area must be restricted to surficial activities and then, only by authorized personnel.

C. COST ANALYSIS

The capital cost of Alternative 4 is estimated at $5,135,000, as presented in Appendix A, Table 14. Operating and maintenance costs, including posttreatment monitoring and maintenance, are provided in Appendix A, Table 15. Since the asbestos is left essentially in place in a secure environment, costs have been allocated for air and surface water monitoring activities for a period of five years after initial remedial actions. Long term visual inspections and maintenance would continue for a total period of 30 years. The monitoring would serve to ensure cap integrity and to detect an asbestos migration from the contained areas. Under Section 121 of CERCLA, 42 U.S.C. Section 9621, an evaluation of the remedial action undertaken at each NPL site is required to confirm or disconfirm effectiveness of the actions to that date.

SELECTED ALTERNATIVE

Section 121 of CERCLA establishes cleanup standards for the site remediation and articulates a preference for remedial actions in which treatment permanently and significantly reduces the volume, toxicity, or mobility of site contaminants. The provision notes that off-site transport and disposal of hazardous substances without such treatment is least favored where practicable treatment technologies are available. The statute mandates selection of a remedial action "that is protective of human health and the environment, that is cost effective, and that utilizes permanent solutions and alternative treatment technologies or resource recovery techniques to the maximum extent practicable."

EPA has reviewed and considered these statutory provisions and the regulations contained in the National Contingency Plan, 40 C.F.R. Section 300, in light of the conditions present at the Ambler Asbestos Site and concludes that Alternative 4 is the most consistent with these requirements. This remediation alternative offers the best combination of effectiveness, implementability, and cost efficiency and involves the use of what can be considered the only currently feasible remedy under CERCLA for asbestos. This alternative meets all applicable or relevant and appropriate requirements or a waiver is justified. The Section on "Evaluation of Alternative 4" describes in detail how ARARs are met or how the waiver is justified. That section further details how the requirements of Section 121 of CERCLA, 42 U.S.C. Section 9621, are met. The proposed cover design is consistent with other EPA and state agency designs that have been proposed and/or approved.

Considering cost, the No Action Alternative (Alternative 1) is the least expensive alternative. However, it does not include treatment, removal, or immobilization of contaminated surface water, sediment or materials in the piles. It meets none of the CERCLA Section 121 objectives to reduce volume, mobility, or toxicity of the waste, and does not meet the remedial action objectives.

Alternatives 2 and 3 (Off-Site Disposal and On-Site Vitrification Solidifation/Stabilization) are extremely costly to implement, with Alternative 3 being the most expensive of all four alternatives.

Alternative 4, On-Site Closure, presents a potential solution to future exposures to contaminants at a much lower cost than Alternatives 2 or 3, although as previously mentioned, some longterm ARARs may be completely met.

Because this remedy will result in hazardous substances remaining on-site, five year reviews, as specific by CERCLA Section 121(c), 42 U.S.C. Section 9621(c), would be required for the remedy, despite the full containment of contamination. As discussed earlier, inspections will be conducted bi-annually for the first five years after the initiation of remedial action and yearly thereafter.

A summary of the comparison of remedial action alternatives is presented in Appendix A, Table 16.

STATUTORY DETERMINATIONS

1. Protection of Human Health and the Environment

The selected remedy will contain the asbestos contamination at the site, which will ensure adequate protection of human health and the environment.

2. Attainment of ARARs

The selected remedy will effectively attain the applicable or relevant and appropriate requirements, where practicable, as set forth in the ARARs section of this ROD.

3. Cost-effectiveness

The selected remedy provides overall effectiveness commensurate to its costs such that it represents a reasonable value for the money.

4. Utilization of permanent solutions employing alternative technologies to the maximum extent practicable

The selected alternative is currently the most appropriate solution for this operable unit and represents the maximum extent to which permanent solutions and treatment can be practicably utilized.

5. Preference for treatment as a principal element

The preference is cannot be satisfied since treatment of the principal waste, asbestos, is not practicable. However, the proposed alternative reduces the <u>toxicity</u>, <u>mobility</u> or volume as a principle element (emphasis added) and also utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

Table 8

Estimate of Capital Costs for Alternative 1:
No Action

Item	Description	Quantity	Unit Cost ($)	Total Cost ($)
1	Fencing to enclose site, installed	6,000 lin ft	15/ft	90,000
2	Warning signs	60	100 ea	600
3	Fence gates with locks	4	1,000 ea	4,000
4	Subtotal			100,000
5	Mobilization/demobilization, construction management, site services (20%)			20,000
6	Technology implementation: designs, plans, specifications, regulatory approvals, insurance, bonds, and permits (20%)			20,000
7	Overhead and profit (10%)			10,000
8	Contingency (15%)			15,000
9	Total (rounded)			165,000

Table 9

Estimate of Operating and Maintenance Costs for Alternative 1: No Action

Item	Description	Quantity	Unit Cost ($)	Total Cost/yr ($)
1	Long-term monitoring			
	● Annual analyses for asbestos (including data validation)			
	- Air	8	500/sample	4,000
	- Water	4	500/sample	2,000
	● Labor: sampling	120 hrs	40/hr	4,800
	● Labor: site inspection	20 hrs	40/hr	800
	● Labor: report	60 hrs	50/hr	3,000
	● Expenses		Lump sum	400
2	Fence maintenance		Lump sum	3,000
3	Subtotal			18,000
4	Administrative (15%)			2,700
5	Contingency (15%)			2,700
6	Annual total (rounded)			23,400

Note: Annual cost/year required for 30-year period after remedial action.

Table 10

Estimate of Capital Costs for Alternative 2:
Off-Site Disposal

Item	Description	Quantity	Unit Cost ($)	Total Cost ($)
1.	Site preparation (roads, staging areas, etc.)		Lump sum	100,000
2.	Lagoon water treatment (includes flocculation, sedimentation, filtration units, rental, operation, and labor)	1.9 million gals	Lump sum	240,000
3.	Treatability study for surface water remediation		Lump sum	50,000
4.	Surface water diversion/ interception ditches	5,000 lin ft	10/lin ft	50,000
5.	Erosion/sedimentation control system			
	● Silt fences, etc.		Lump sum	50,000
	● Sedimentation basins (2)		Lump sum	250,000
6.	Health and safety equipment/ air monitoring equipment	2,000 days	250/day	500,000
7.	Subtotal			1,240,000
8.	Mobilization/demobilization, construction management, site services (25%)			310,000
9.	Technology implementation: designs, plans, specifications, regulatory approvals, insurance, bonds, and permits (10%)			124,000
10.	Contingency (30%)			372,000

Table 11

Estimate of Operating and Maintenance Costs for Alternative 2: Off-Site Disposal

Item	Description	Quantity	Unit Cost ($)	Total Cost/yr ($)*
1.	Field inspections, monitoring, reporting during remedial agencies (agencies and borough)	7 years	40,000/yr	40,000
2.	Excavation			
	● Locust Street pile	615,000 cu yds	20/cu yd	1,757,000
	● Plant pile	640,000 cu yds	20/cu yd	1,828,600
	● Lagoon and settling basins	4,500 cu yds	10/cu yd	6,400
3.	Soil analyses for cleanup verification	1,000 tests	750/test	107,000
4.	Backfill excavated lagoon, settling basins, and piles with clean soils	175,000 cu yds	10.50 cu yd	262,500
5.	Bagging/special loading of asbestos wastes before off-site transport, truck decontamination, etc.	833,500 cu yds	5.00/cu yd	595,400
5.b	Dewatering/stabilization of Ca/Mg carbonate wastes before transport. Stockpile, stabilize with 10% CKD addition, mixing, truck decontamination, etc.	426,000 cu yds	15/cu yd	912,900
6.	Transportation of asbestos-contaminated materials			
	● Locust Street pile	615,000 cu yds	15/cu yd	1,317,900
	● Plant pile	640,000	15/cu yd	1,371,400
	● Lagoon and settling basins (from settling and filtering water only)	4,500 cu yds	15/cu yd	9,600

AR001814

Table 11
(continued)

Item	Description	Quantity	Unit Cost ($)	Total Cost/yr ($)*
7.	Disposal of asbestos-contaminated materials			
	● Locust Street pile	615,000 cu yds	75/cu yd	6,589,300
	● Plant pile	640,000 cu yds	75/cu yd	6,857,100
	● Lagoon and settling basins	4,500 yds	75/cu yd	48,200
8.	Dust control (wetting)			17,100
9.	Regrade/revegetate (hydroseed)			
	● Locust Street pile area	450,000 sq ft	0.10/sq ft	6,400
	● Plant pile area	400,000 sq ft	0.10/sq ft	5,700
	● Lagoon and settling basin area	85,000 sq ft	0.10/sq ft	1,200
10.	Air and surface water monitoring during on-site activities			
	● Labor, laboratory analyses, and reporting		Lump sum	285,700
11.	Post-remediation action monitoring	5 years	2,000/yr	**
12.	Subtotal			
	Years 1 through 7			22,020,000
	Years 8 through 12			2,000
13.	Administrative (15%)			
	Years 1 through 7			3,303,000
	Years 8 through 12			300
14.	Contingency (25%)			5,505,000
				500
15.	Total (rounded)			
	Years 1 through 7			30,828,000
	Years 8 through 12			2,800

*Based on assumption that remedial activities will take 7 years to complete.
**

AR001815

Table 12

Estimate of Capital Costs for Alternative 3:
On-Site Solidification/Vitrification

Item	Description	Quantity	Unit Cost ($)	Total Cost ($)
1.	Site preparation (roads, staging areas, etc.)		Lump sum	200,000
2.	Construction of electrical substation		Lump sum	250,000
3.	Vitrification furnace and equipment (5 tons/hr)		Lump sum	2,200,000
4.	Installation of vitrification furnace and equipment		Lump sum	5,500,000
5.	Purchase of solidification plant (100 tons/hr)		Lump sum	1,100,000
6.	Installation of solidification plant		Lump sum	2,200,000
7.	Construction of a storage area for untreatable debris		Lump sum	50,000
8.	Water treatment unit (includes flocculation, sedimentation, filtration)	1.9 million gals	Lum sum	240,000
9.	Treatability study for surface water remediation		Lump sum	50,000
10.	Treatability study for solidification of $CaCO_3$ compounds		Lump sum	50,000
11.	Treatability study for vitrification of asbestos materials		Lump sum	50,000

*Costs are gross estimates only; vendor(s) unwilling/unable to supply detailed information at the present time.

Table 12
(continued)

Item	Description	Quantity	Unit Cost ($)	Total Cost ($)
12.	Pilot plant for vitrification process (includes temporary electrical hookup)		Lump sum	1,000,000*
13.	Shredding of oversized materials (assume 1% of pile contents)	126,000 cu yds	50,000	50,000
14.	Setup for solidification/ stabilization operation at on-site location(s)		Lump sum	500,000
15.	Surface water diversion/ interception ditches	5,000 lin ft	10/lin ft	50,000
16.	Erosion/sedimentation control system			
	• Silt fences, etc.		Lump sum	50,000
	• Sedimentation basin(s) (2)		Lump sum	250,000
17.	Gabions for Locust Street pile, installed	500 lin ft	200/lin ft	100,000
18.	Health and safety equipment/ air monitoring equipment	10,000 days	250/day	2,500,000
19.	Fences (installed)	7,500 lin ft	15	113,000
20.	Warning signs	75	100 ea	7,500
21.	Fence gates and locks	6	1,000 ea	6,000
22.	On-site disposal of treated wastes	1,000,000 cu yds	20/cu yd	20,000,000

*Costs are gross estimates only; vendor(s) unwilling/unable to supply detailed information at the present time.

Table 12.
(continued)

Item	Description	Quantity	Unit Cost ($)	Total Cost ($)
23.	Off-site disposal of treated wastes	260,000 cu yds	75/cu yd	19,500,000
24.	Subtotal			55,517,000
25.	Mobilization/demobilization, construction management, site services (22 %)			12,214,000
26.	Technology implementation: designs, plans, specifications, regulatory approvals, insurance, bonds, permits (22%)			12,214,000
27.	Overhead and profit (10%)			5,552,000
28.	Contingency (25%)			13,879,000
29.	Total (rounded)			99,376,000

*Costs are gross estimates only; vendor(s) unwilling/unable to supply detailed information at the present time.

Table 13

Estimate of Operating and Maintenance Costs for Alternative 3:
On-Site Solidification/Vitrification

Item	Description	Quantity	Unit Cost ($)	Total Cost/yr[1] ($)
1.	Health and safety equipment (expendables)	10,000 days	750/day	125,000
2.	Shredding of oversized materials (assume 0.5% of pile volumes)	6,300	20/cu yd	6,000
3.	Solidification of $CaCO_3$ compounds (includes labor)	426,00 cu yds	100/cu yd	2,130,000
4.	Vitrification of asbestos materials processing costs (includes labor)[2]	1,042,000 tons	160/ton	8,336,000
5.	Excavation/hauling to on-site vitrification unit	1,260,000 cu yds	20/cu yd	1,260,000
6.	Soil analyses for cleanup verification	1,000 samples	750/sample	38,000
7.	Backfill excavated lagoon and settling basins and piles with clean soil	175,000 cu yds	10.50/cu yd	92,000
8.	Placement of vitrified and solidified product back in pile areas	879,000 cu yds	4.65/cu yd	204,000
9.	Backfill clean soil over the vitrified and solidified product piles	70,000 cu yds	10.50/cu yd	37,000
10.	Off-site disposal of materials that cannot be backfilled on-site[3] (includes transportation)	376,000 cu yds	90/cu yd	1,692,000

[1]Based on assumption that remedial activities will take 20 years to complete.
[2]Includes electrical cost of 1,000 kw-hrs/ton of processed material at $0.07/kw-hr (maintenance costs are not well defined due to lack of vendor information.
[3]Assume 30 percent must be disposed of off-site.

Table 13
(continued)

Item	Description	Quantity	Unit Cost ($)	Total Cost/yr[1] ($)
11.	Regrade/revegetate (hydroseed)			
	• Locust Street pile area	450,000 sq ft	0.10/sq ft	
	• Plant pile area	400,000 sq ft	0.10/sq ft	
	• Lagoon and settling basin area	85,000 sq ft	0.10/sq ft	
	• Total	935,000	0.10/sq ft	5,000
12.	Air and surface water monitoring during activities			
	• Laboratory analyses and reporting		Lump sum	400,000
13.	Subtotal			14,325,000
14.	Administrative (15%)			2,149,000
15.	Contingency (25%)			3,581,000
16.	Total (rounded)			20,055,000

Table 14

Estimate of Capital Costs for Alternative 4: On-Site Closure

Item	Description	Quantity	Unit Cost ($)	Total Cost ($)
1.	Site preparation (roads, storage areas, etc.)	Lump sum	---	25,000
2.	Water treatment unit (includes 2,000,000 gal flocculation, sedimentation, filtration)	Lump sum	---	240,000
3.	Treatability study for surface water remediation	Lump sum	Lump sum	50,000
4.	Surface water diversion ditches	6,500	10/lin ft	65,000
5.	Erosion/sedimentation control system			
	● Silt fences, rip rap, flumes, etc.	Lump sum	---	100,000
	● Sedimentation basin(s)	2		250,000
6.	Grading of piles to create crown for positive drainage (includes soil purchase)	7,500 cu yds	15/cu yds	112,500
7.	Geotextile (installed)			
	● Locust Street pile	162,000 sq ft	0.18/sq ft	29,160
	● Plant pile	198,000 sq ft	0.18/sq ft	35,640
	● Lagoon and settling basins	40,500 sq ft	0.25/sq ft	10,125
8.	Backfill for lagoon and settling basins (low permeability soils with high compactive effort); grade for positive drainage	17,500 cu yds	15/cu yd	262,500

Table 14
(continued)

Item	Description	Quantity	Unit Cost ($)	Total Cost ($)
9.	Soil cover (installed)			
	● Low-erosion soils (30 in)			
	- Locust Street pile	15,000 cu yds	15.00/cu yds	225,000
	- Plant pile	18,300 cu yds	15.00/cu yds	274,500
	● Topsoil (6 in)			
	- Locust Street pile	3,000 cu yds	17.50/cu yds	52,500
	- Plant pile	3,700 cu yds	17.50/cu yds	64,750
	- Lagoon and settling basins	15.00 cu yds	17.50/cu yds	26,250
	● Hydroseed			
	- Locust Street pile	18,000 sq yd	1.00/sq yd	18,000
	- Plant pile	22,000 sq yd	1.00/sq yd	22,000
	- Lagoon and settling basins	4,500 sq yd	1.00/sq yd	4,500
10.	Repair erosion on pile side slopes			
	● Low-erosion soils	2,750 cu yds	35/cu yds	96,250
	● Topsoil	1,200 cu yds	35/cu yds	42,000
	● Erosion-control netting (including installation)	2,000 sq yd	5.00/sq yd	10,000
11.	Tree/shrub removal (includes impregnated geotextile treatment)	Lump sum	---	180,000

Table 14
(continued)

Item	Description	Quantity	Unit Cost ($)	Total Cost ($)
12.	Gabions for Locust Street pile (installed)		Lump sum	200,000
13.	Side slope Buttresses/ Reinforcement*		Lump sum	250,000
14.	Fences (installed) 8 feet tall with barbed wire	6,000 lin ft	15.00/ft	90,000
15.	Warning signs	60	100 ea	6,000
16.	Gates with locks	4	1,000	4,000
17.	Construct earthen berm 6 in. high) along Locust Street and hydroseed		Lump sum	20,000
18.	Air and surface water monitoring during remedial activities			
	• Labor, laboratory analyses and reporting		Lump sum	200,000
19.	Health and safety equipment/ air monitoring equipment	200 days	150/day	30,000
20.	Subtotal			2,985,675
21.	Mobilization/demobilization, construction management, site services (22%)			656,850

*Assumes remedial design geotechnical analysis work indicates slopes essential stable in the future with new soil cap and construction loads, except local areas.

AR001823

Table 14
(continued)

Item	Description	Quantity	Unit Cost ($)	Total Cost ($)
22.	Technology implementation: designs, plans, specifications, regulatory approvals, insurance, bonds, permits (25%)			746,620
23.	Contingency (25%)			746,620
24.	Total (rounded)			5,135,000

Table 15

Estimate of Operating and Maintenance Costs for Alternative 4:
On-Site Closure

Item	Description	Quantity	Unit Cost ($)	Total Cost Per Year[1] Remediation ($) 1	2	3	4	5	6	7–30
1.	Inspections (biannually first 5 years, annually afterward)		Lump sum		1,000	1,000	1,000	1,000	4,000[2]	800
2	Short-term air and water monitoring	12 samples	500/sample		6,000	6,000	6,000	6,000	6,000	
3.	Maintenance									
	• Mowing									
	– Locust Street pile	18,000 sq yd	0.24/sq yd		4,300	4,300	4,300	4,300	4,300	4,300
	– Plant pile	22,000 sq yd	0.24/sq yd		5,300	5,300	5,300	5,300	5,300	5,300
	• Erosion repair and reseeding				25,000	20,000	15,000	15,000	10,000	10,000
4.	Fence maintenance		Lump sum		3,000	3,000	3,000	3,000	3,000	3,000
5.	Subtotal				44,600	39,600	34,600	34,600	32,600	23,400
6.	Administrative (15%)				6,700	5,900	5,200	5,200	4,900	3,500
7.	Contingency (25%)				11,200	9,900	8,700	8,700	8,200	5,900
8.	Total (rounded)				63,000	55,000	49,000	49,000	46,000	33,000

[1]Present worth cost for this alternative has been estimated for a length of 30 years where the cost incurred in year 6 is the annual cost from years 7 through 30.
[2]Includes 5-year report.

Table 16

Summary and Comparison of Remedial Alternatives for the Ambler Asbestos Piles Site

Alternative	Present Worth[1] Cost ($1,000)	Technical Considerations (Performance/ Reliability/Implementability/Safety)	Public Health and Environmental Concerns	Institutional Requirements/ Community Response	Comments
1. No Action Upgrade Site Security Monitoring/ Inspections	306	Perimeter fencing, gates, and signs must be carefully maintained.	Does not address any of the site public health and environmental issues identified in the RI and EA. Restricts access to piles and lagoon and reduces risks due to direct contact with asbestos materials; and drownings associated with lagoon. Potential present and future risks exist for trespassers. Does not address potential future risks to public health and environment from airborne asbestos fibers and migration of asbestos fibers and migration of asbestos from piles/lagoon via erosion of piles and sediment transport.	Does not meet remedial action objectives. Public opposition anticipated for the no action alternative due to potential future risks to on- and off-site receptors. Does not meet NESHAPS or PADER guidelines for cover systems or containment requirements for contaminants. Compliance with other site-specific ARARs is not addressed over the short- or long-term. Requires provisions for periodic site inspections and monitoring are required.	The no action alternative does not attain applicable public health and environmental standards.

[1]Based on 10 percent interest rate.

AR001826

Table 16
(continued)

Alternative	Present Worth[1] Cost ($1,000)	Technical Considerations (Performance/ Reliability/Implementability/Safety)	Public Health and Environmental Concerns	Institutional Requirements/ Community Response	Comments
2. Excavation/ Removal - Off-Site Disposal Excavation/ dredging of waste piles and lagoon sediments - Pump-out/ remove lagoon surface water - Excavate - Dewatering of sediments On-site treatment of lagoon surface water and sediment water using precipitation flocculation, sedimentation, and/or filtration processes	109,653	Excavation/dredging for conventional applications is feasible and commonly practiced at site remediations. Implementability may be difficult for this site. Contingency measures are required for removal of large-sized debris from the waste piles. Would require extensive design and preconstruction planning due to the low strength and steep side slopes of the piles (inaccessible to large/heavy equipment) and the consistency of the calcium/magnesium carbonate layer of each pile. Contingency measures are required for site safety due to potential collapse of piles during removal operations. Sediment control and dust control measures are required. Stabilization of some of the materials excavated from the site may be required to allow for bulk transport off-site. Special handling (such as bagging) of asbestos-contaminated materials is required prior to transport.	Addresses all site environmental issues and contaminant pathways identified in the RI; all materials imposing potential risk removed from site. It is expected to significantly reduce or eliminate the potential public health risks and and environmental impacts resulting from direct contact, airborne asbestos, and contaminant migration via sediment transport. Excavation of materials in piles presents potential substantial short-term risks to workers, public health, and environment due to release of asbestos fibers into ambient air and collapse of piles (direct contact with materials in off-site areas adjacent to site). Air monitoring is required.	Construction permits for on-site excavation may be required to comply with local building codes. State erosion, sediment, and dust control ordinances require compliance during excavation/removal activities. Permit and/or plan approval may be required for on-site point discharge of treated surface/sediment waters (or discharge to POWT plant). Possibility exists for discharge according to current site NPDES permit. May be opposition from local community due to risks involved with disturbance/removal of the piles. This can result in potential delays.	This alternative expected to exceed applicable public health and environmental standards for the site. The removal/off-site is considered in accordance with SARA guidance and for comparison with the on-site options.

[1]Based on 10 percent interest rate.

AR001827

Table 16
(continued)

Alternative	Present Worth[1] Cost ($1,000)	Technical Considerations (Performance/ Reliability/Implementability/Safety)	Public Health and Environmental Concerns	Institutional Requirements/ Community Response	Comments
2. Excavation/ Removal – Off-Site Disposal (continued)		Extensive air monitoring would be required during removal operations to ensure worker safety from potential airborne asbestos fibers.	Potential impacts are associated with the transportation operation.	Compliance with OSHA requirements for ambient air and surface water may be difficult to achieve during removal operations.	
Backfill, regrade, and revegetate where necessary		Extensive implementation time to remove large volumes of material (estimated minimum of 7 years to remove all materials).			
Off-site disposal in secure landfill		On-site treatment of lagoon surface water is required. Concentrated process streams from this treatment process require on- or off-site disposal. Pilot and/or laboratory studies required prior to implementation to determine optimum treatment scheme. Utilizes conventional wastewater treatment techniques.		Availability of off-site landfill space is questionable. Only two landfills in southeastern Pennsylvania are permitted to accept asbestos. Opposition to disposal of large volumes of asbestos waste at off-site facility by public near off-site facility can be expected.	
		Off-site disposal in a secure (or RCRA-approved) municipal landfill is feasible based on well-developed techniques and standard engineering practices. Capacity is limited. Needs to be determined if waste materials can be accepted in municipal landfill as special handling municipal waste.		Large quantity of waste from Ambler Asbestos Piles site must be accepted by the landfill; approval must be acquired to dispose of materials in a municipal landfill as a "special" handling municipal waste.	
				Potential of liability remains for materials disposed of in the municipal landfill in the event of failure.	

[1]Based on 10 percent interest rate.

Table 16
(continued)

Alternative	Present Worth[1] Cost ($1,000)	Technical Considerations (Performance/ Reliability/Implementability/Safety)	Public Health and Environmental Concerns	Institutional Requirements/ Community Response	Comments
3. On-Site Vitrification/Solidification	270,116	Process has not truly been proven on a full-scale basis. Design requirements, construction technologies, operational problems, and site-specific considerations are undefined. Excavation of piles is a major concern. Problems and potential physical and chemical dangers related to removing asbestos contaminated wastes. Underlying calcium/magnesium carbonate wastes are saturated and exhibit almost negligible shear strength. During remediation it is likely that the technology will not be able to meet ARARs regarding ambient air and/or surface water quality. Solidification techniques for calcium/magnesium carbonate wastes have not yet been tested. Solidification would increase waste volume to the extent that off-site landfill must be considered because there would not be enough room at the site. Vitrified product most likely will have no reuse value.	Short-term risks to public health and the environment are likely to occur as a result of intrusion into the waste piles and release of asbestos fibers. On-site workers will be exposed to physical and and chemical risks due to excavation of the piles, lagoon, and settling basins. The estimated length of remediation is 22-45 years. This time period presents potential risks due to prolonged exposure to site emissions. Decontamination procedures for workers leaving the plant would be extensive. Still, it is expected that a significant amount of asbestos fibers could be carried off-site.	Off-site landfilling may be required. A potential shortage of landfill capacity is currently projected for regions around the site. This situation would not be conducive for the large volumes involved at the Ambler Asbestos Piles site. Operations would require intermediate stockpiles. Public reaction to this situation is anticipated to be unfavorable due to exposure risks to receptors. Transportation safety concerns involved with hauling the vitrified/ solidified product off-site may generate unfavorable public reaction. Site-specific ARARs related to air and surface water quality would likely not be met during remedial activities.	This alternative may not attain all applicable ARARs.

[1]Based on 10 percent interest rate.

AR001829

Table 16
(continued)

Alternative	Present Worth[1] Cost ($1,000)	Technical Considerations (Performance/ Reliability/Implementability/Safety)	Public Health and Environmental Concerns	Institutional Requirements/ Community Response	Comments
3. On-Site Vitrification/Solidification (continued)			Ambient a[illegible] occupational air, and surface water quality ARARs may be exceeded at times during remediation. Implementing this alternative may cause more migration of asbestos fibers to off-site locations than if no remediation beyond the current status was attempted.	CERCLA According to ~~SARA~~ guidelines, the use of treatment technologies may not be practicable at some sites with large volumes of potentially low concentrated wastes (e.g., large municipal landfills or mining sites). Remedies involving treatment at such sites may be extremely expensive or difficult to implement.	
4. On-Site Closure	5,144	Geotextile and soil cover for the waste piles, lagoon and settling basin sediments will serve as long-term protection of the surrounding environment from exposure to asbestos fibers. Cover placement will utilize lightweight construction equipment. The stability of the piles may not be sufficient for heavy duty machinery. Three feet of soil above the geotextile will provide sufficient protection of the waste materials from the effects of freeze/thaw weathering.	This alternative can be expected to result in significant long-term reduction of potential public health risks and environmental impacts resulting from direct contact and migrating asbestos fibers via sediment, surface water, and air transport mechanisms. Proper grading, installation, and post-closure inspection will ensure that the cover remains and an adequate barrier exists between the asbestos materials and the ground surface.	Need approval from the Montgomery County Conservation District for land disturbance. Sediment and erosion control plan is required by soil conservation district office. Need approval from PADER for stream encroachment and discharge of treated waters on-site. Must meet OSHA guidelines for asbestos workers. Cap design is consistent with other EPA designs that have been approved for asbestos sites.	Alternative potentially attains all applicable requirements, except PADER 3H:1V Sideslope ARAR

[1]Based on 10 percent interest rate.

AR001830